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THE DYEING OF DYNEL AT ELEVATED TEMPERATURES

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INTRODUCTION

IMPORTANT advances in the techniques for dyeing both the old and the new synthetic fibers have been made in the past several years. Significant among these advances has been the development and acceptance by much of the industry of processes for dyeing staple at elevated temperatures under pressure.

The dyeing of Dynel fiber in pressure equipment has been successfully practiced in many dyehouses for some time. Advantages that have been obtained by pressure dyeing are: a decrease in the quantities of dyestuffs used, shorter dyeing cycles in general, better cleanup after dyeing, and improved product quality and uniformity.

The dyestuffs which function satisfactorily on Dynel under atmospheric dyeing conditions appear to function equally as well in the elevated temperature range (212-220°F) normally used for Dynel. Few special problems are involved as will be noted in the general procedure below. The flow of liquor through the cake, especially when hot, has an important bearing on the tendency for the cake to pack. This packing with the attendant excessive pressures is often responsible for unlevel dyeings and bypassing or channeling. Experience has shown that flow rates in the range of one-and-one-half gallons of liquor per minute per pound of fiber result in satisfactory dyeings.

PROCEDURE

The dyestuffs, assistants and antifoam are added to the bath which has been preheated, generally to 190-200°F. The stock is loaded, care being taken to form a cake of uniform density. The use of poles or pitchforks to force the stock beneath the surface of the hot bath should be avoided. The machine is closed and circulation started. The temperature is then brought to 220°F at a rate of about 1°F per minute and maintained for 45 minutes. At the end of the dyeing period the steam is turned off, circulation stopped and the bath is dropped hot. The cake is then cooled by filling the kettle from the bottom with cold water with the pump off. After the machine is refilled with water the pump should remain off for about ten minutes. The dyed stock is scoured if desired, extracted, and dried.

After dyeing, the fiber must be treated to restore the natural luster and to develop the shade completely. This is done by drying the fiber and then exposing it briefly to dry heat at a temperature of 265°F, slightly higher than the 250°F normally employed to reluster Dynel dyed at atmospheric pressure.

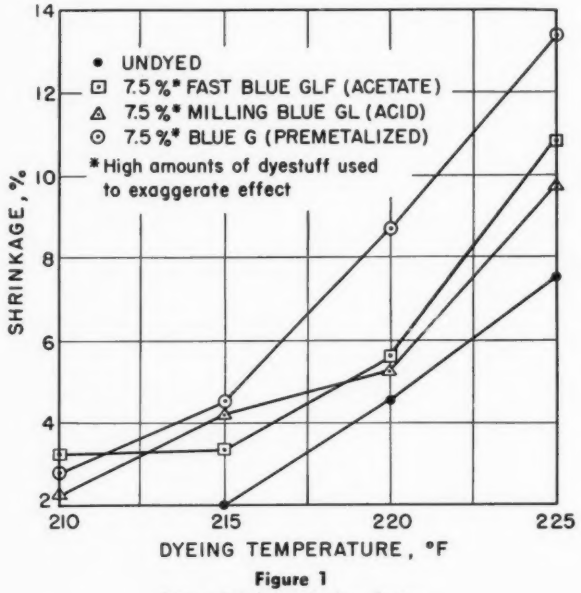

Figure 1
Fiber shrinkage during dyeing

CHARACTERISTICS OF DYEINGS MADE AT ELEVATED TEMPERATURES

The increased color value of the dyes realized in medium and deep shades is an important advantage to be gained from the high-temperature dyeing techniques. Each 5°F increment of temperature above the boil produces a significant increase in shade depth. However, as shown by Figure 1, increased temperature also brings about increased fiber shrinkage. The same figure gives indication that certain dyes have a definite swelling action on Dynel and if used in excessive amounts will contribute to the shrinkage of the fiber. Little if any further shrinkage occurs during the relustering operation (Figure 2).

The optimum temperature for dyeing Dynel under pressure is 220°F. At this temperature, a significant increase in shade depth is gained without excessive shrinkage, although again it is worth noting that some dyestuffs cause higher shrink-

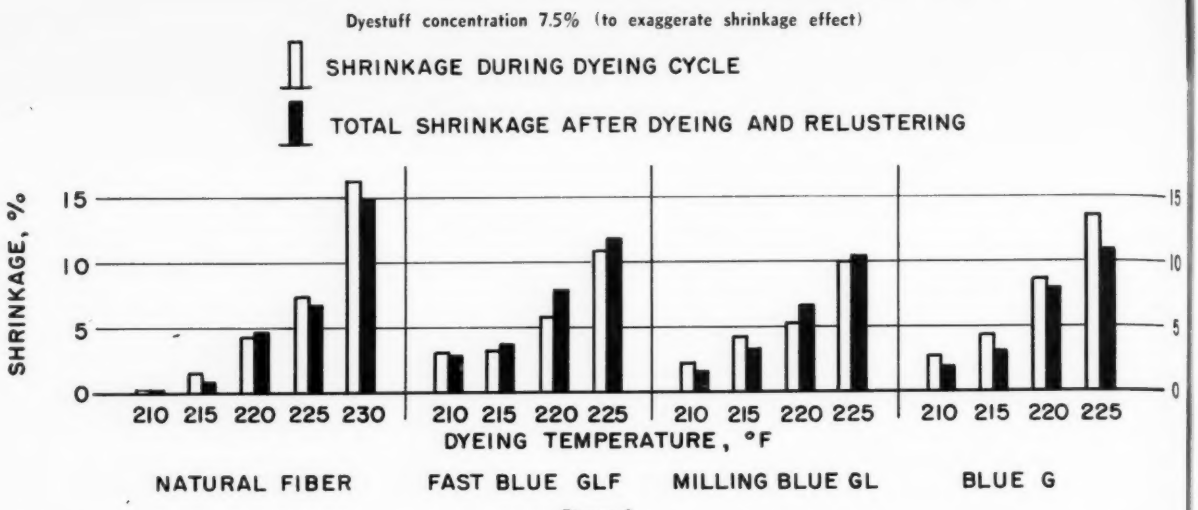

Figure 2

A comparison of the fiber shrinkage occurring during pressure dyeing of Dynel at different temperatures using acetate, acid, and premetalized dyestuffs

ages than others (Figure 3). It should be emphasized that, in the dyeings presented in the preceding figures, very high amounts of dye were used to exaggerate shrinkage effects; in the many commercial-scale pressure dyeings of Dynel which have been made shrinkage has presented no problem.

A dyeing was made at 220°F with 3% Blue G while a control was run at 210°F using 4% dyestuff. The former was definitely the deeper of the two. Where expensive dyes must be employed, the economic advantages of pressure dyeing are obvious.

In respect to levelness, dyeings made at elevated temperatures are equal or superior to those made at the boil. Similarly, colorfastness to light and washing of pressure-dyed fiber is as good as or better than that of conventionally dyed fiber.

Typical formulas employing acetate, acid and premetalized colors will serve to illustrate further the simplicity of the process.

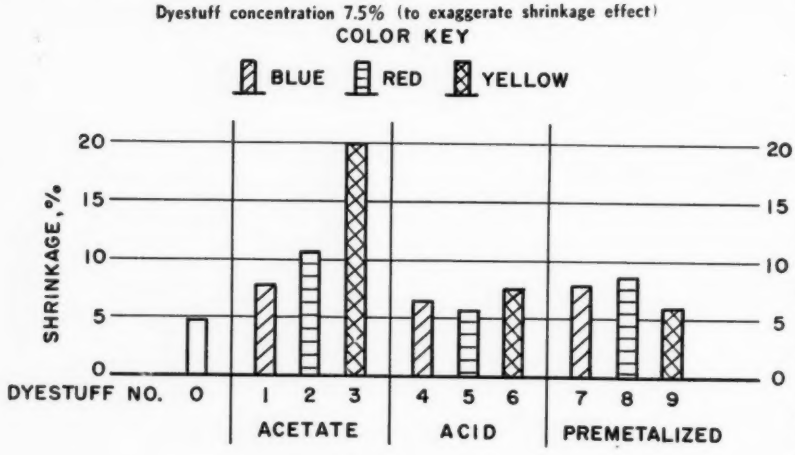

Figure 3

Pressure dyeing of Dynel yarn dyed at 220°F with acetate, acid and premetalized dyes, and relustered at 266°F

Dyestuff No.	
0	None
1	Fast Blue GLF
2	Fast Red GLF
3	Fast Yellow GLF
4	Milling Blue GL
5	Milling Red SWB
6	Milling Yellow 5G
7	Blue G
8	Fast Red G
9	Yellow NR

Acetate dyes

Shade: Marine Kersey Green	*(%)*
Yellow GLF	2.6
Blue GLF	1.6
Red GLF	0.56
Igepon T-73	2.0
DC Antifoam A Emulsion	0.5

Neutral-dyeing premetalized dyes

Shade: Grey	*(%)*
Blue G	0.1
Brown RD	0.06
Red B	0.05
Igepon T-73	2.0
DC Antifoam A Emulsion	0.5

Acid dyes

Shade: Brown	*(%)*
Milling Blue GL	2.0
Golden Brown NL	3.0
Milling Yellow 5G	2.0
Cupric sulfate, anhydrous	2.0
Glyoxal (30% solution)	2.0
Igepon T-73	0.5
DC Antifoam A Emulsion	0.25

In the application of acid dyes by the cuprous-ion method, the cupric sulfate is dissolved in water and added to the bath containing the Igepon T-73 and dyestuffs; the glyoxal is then added. Zinc formaldehydesulfoxylate, normally used in the cuprous-ion technique for dyeing with acid colors at atmospheric pressure, causes overreduction of the cupric ion when employed at elevated temperatures, yielding dyeings of inferior colorfastness to light. The milder reducing action of glyoxal yields dyeings of excellent lightfastness.

SUMMARY

Dynel is successfully dyed under pressure at temperatures up to a maximum of 220°F with a wide range of acetate, acid and premetalized colors. Few special problems are involved, and shades with excellent fastness properties are obtained with considerable savings in dyestuff cost and dyeing time.

PROTEIN STRUCTURE IN RELATION TO SOME DESIRABLE FIBER AND FABRIC PROPERTIES*

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PURPOSE

IN this paper, we shall attempt to look at the desirable fabric and fiber properties which distinguish protein fibers from other fibers in their accepted uses. Before doing this, we shall attempt to connect some of the properties which the user values with the properties which we, as organic and physical chemists, or industrial producers, recognize as characteristic of protein structure.

We shall limit the effort to an outline only — a trial "mock up" of a future structure of knowledge, nailed together here and there with a few of the facts which are at present available. We shall try to present one outline of the ABC's of this field, at least as some workers see them, and to fill in some of the other letters of the alphabet. However, this is just one trial at such an alphabet — any number could be composed.

DESIRABLE FACTOR PROPERTIES

It is admittedly difficult to define "desirable fabric properties" except in terms of end use. Our consideration can well start, therefore, with the classical end uses of the natural protein fibers wool and silk, in wearing apparel and household fabrics. Here the desirables may not be as easy to define quantitatively as in engineering applications, but at least we all have the advantage of our own personal experience as users of textiles.

While the desirable in fabric properties might seem to be at the mercy of the whim of fashion, actually, contact with the agents of users of textiles — the designers, the fashion experts, the salesmen, and the store buyers — convinces one that underlying the novelty and change of fashion there are certain basic needs. To emphasize how basic these are, we can number them as A, B, and C:

Appearance
Balanced cost
Comfort

Let us, as chemists, proceed to analyze these ABC properties a bit further. Take A for Appearance first — certainly this is the most powerful driving force in textile sales for personal use. Still thinking in users' terms, we can break this idea into smaller parts:

APPEARANCE
- Color
- Shapeholding or shape conforming
- Special structures—nap; crease
- Sheer or solid
- Luster or matt

Already we can see a chemical connection — color and dyeability — and special connections with protein chemistry, since the reactive groups of proteins permit reactions with acid or basic dyes. The other, more physical or mechanical aspects of this list also have their chemical connotations, but we shall return to that later, since the mechanical or fiber properties of protein fibers are basic to and common to all three of the ABC users' desires.

The B group can also be analyzed — still in users' terms:

BALANCED COST
- One season—novelty *versus*
  - Many seasons—classic
- Satisfactory maintenance
- Cost within 1/n of income

One sees that the elements of strength and durability — both involving chemical considerations — come in the question of fashion or luxury goods versus classics or staples. Other chemical considerations are involved in satisfactory maintenance — to wash, to dryclean, how hot an iron? And still others, including cost and availability of raw materials, in putting the dollars per year cost within the consumer's clothing budget.

The third desirable — the C for Comfort group — is responsible for satisfaction and repeat sales, and also for impulse sales. This we can also expand:

COMFORT
- Moisture and static relations
- Warmth-coolness relations
- Touch relations:
  - Soft or harsh (scratchy)
  - Resilient or dead
  - Yielding or hard

Rather than explain each of these terms at this point, beyond the degree to which the terms explain themselves, let us consider their connections with the structure of proteins, and thus attempt to relate these consumers' desires to chemical and physical chemical properties. Then we can hope that some of the economic and aesthetic, commercial or textile, physical and psychophysical terms, which we have been using, can be given an interpretation in the chemistry and physics of textiles made from protein fibers.

PROTEIN STRUCTURE AND FIBER PROPERTIES

Coming at our problem, that of relating protein structure to desirable fiber and fabric properties, from the other side, we can ask, what are the special characteristics of protein fibers? A partial listing of the more important differences between proteins and other fiber forming polymers can be given in terms of three other letters of the alphabet——M. N, and O:

Multiplicity of monomers
Numerous reactive groups
Organization more amorphous than crystalline

In view of the great amount of discussion of the forms of molecular organization of keratin in wool, as shown by x-ray diagrams, it is worth remembering that, in the fiber forms of keratin, the crystalline or fiber-organized portions of the keratin chains show only as rather modest intensifications of the arcs at certain broad regions.

The other natural protein fiber, silk, however, is known to show a rather well developed wide angle x-ray crystal diagram, and it might even be questioned whether silk conforms to either the M or the O of the MNO properties. The M (Multiplicity of monomers) cannot be too lightly conceded, since, according to data compiled by Howitt *(9)*, 80% of silk fibroin is accounted for by three amino acids, ie, glycine, alanine, and serine, and there is evidence that the crystalline portion of silk arises from long "runs" of just three amino acids. However, Howitt points out, "In contrast with cellulosic fibers, the formation of amorphous regions in silk may be considered obligatory and not incidental to the structure," because of the effect of the other 20%, which includes at least 12 other amino acids. We should limit ourselves here to noting that the two natural protein fibers, wool and silk, show that there is potentially an extremely wide range of properties available in the realm of protein fibers. It will be of interest to see, with respect to the man-made protein fibers, how much they resemble the one or the other of the natural models.

(Continued on page 237)

* Presented at the Symposium on Protein Fibers, Division of Polymer Chemistry, 126th National Meeting, American Chemical Society, New York, September 16, 1954.

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Proceedings of the
American Association of Textile Chemists and Colorists

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APRIL 9, 1956

1955 Annual Convention——

RELATIVE EFFICIENCY OF CHELATING AGENTS*

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This paper describes a number of experimental methods for determining the relative efficiency of chelating agents in specific textile processes. Control of calcium, copper, and iron by either quantitative or qualitative procedures is discussed. Test conditions can be selected to correspond to many wet operations in scouring, bleaching and dyeing.

The data indicate, for example, that ethylenediaminetetraacetic acid (EDTA) is more effective in controlling copper in a peroxide bleach bath than hydroxyethyl ethylenediaminetriacetic acid (EDTA-OH). On the other hand, EDTA-OH is more effective than EDTA in controlling iron in a soda ash bath. A balanced chelating agent is described which is effective in a wide variety of textile processing operations.

INTRODUCTION

DURING the past 10 years the use of organic chelating agents for control of hard water and trace metal ions has grown quite rapidly. These products were first used in the textile industry and this industry probably remains the largest market even though the utility of these materials is now recognized in a great variety of industrial processes.

The number of textile operations in which organic chelates are used is very large and will no doubt continue to grow *(1)*. Table I may be considered as a brief summary of the most important processing steps in which chelating agents have been found useful. The purpose of this paper, however, is not to review textile applications but to suggest a few practical evaluation procedures.

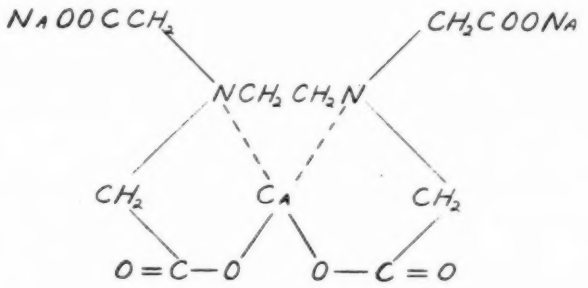
Although a wide variety of compounds have been prepared and studied for chelating efficiency *(2, 3)* one of the most effective compounds is ethylenediaminetetraacetic acid (EDTA). A more recent development from the commercial standpoint is N-hydroxyethyl ethylenediaminetriacetic acid (EDTA-OH). These two products are sold under several different trade names. Calcium complexes of these two compounds are shown schematically in Figure 1. These complexes probably have an octahedral structure in which calcium exhibits a covalency of six *(2)*.

AVAILABLE TESTS FOR EFFICIENCY

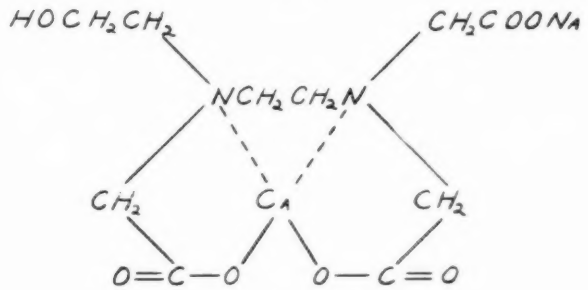
Organic chelating agents are sold in many forms usually with a specified chelating capacity in terms of milligrams of calcium carbonate complexed per milliliter or per gram of product. This measure of performance can be determined readily by titrating an aliquot portion of chelating agent with a soluble calcium salt in the presence of oxalate ions. The end point is noted by appearance of turbidity due to formation of insoluble calcium oxalate.

The formation of insoluble calcium silicate is undesirable in many bleaching operations and a titration method for chelating agents is feasible using calcium silicate as the end point. Both the silicate and oxalate procedures give measures of complexing capacity.

More accurate potentiometric methods



EDTA



EDTA — OH

Figure 1

* Presented by G M Gantz before the Symposium on Chemical Agents in Textile Processing in the West Room of the Haddon Hall Hotel in Atlantic City, N J, on September 24, 1955.

for determining organic chelating agents were recently devised by Siggia, Eichlen and Rheinhart *(4)*. They found that EDTA and other chelates could be titrated with mercury in a pyridine-water buffer using a silver electrode. The presence of ammonia triacetic acid (ATA) does not interfere with this titration. A similar titration may be carried out with calcium chloride using a mercury on platinum electrode although the breaks are not quite as sharp. An amperometric titration method for EDTA has also been developed recently *(5)*.

Table II shows a comparison of the calcium complexing capacity for three chelating agents determined by 3 different methods. Chelates A and B are commercial grades of EDTA and EDTA-OH respectively, while Chelate C is a balanced commercial product designed to exhibit a maximum range of effectiveness.

It might be thought that the complexing power rather than the complexing capacity would be a better criterion for chelating efficiency. The metal complex formation constant K defines the ratio of chelated metal ions and partially chelated metal ions in equilibrium with free metal ions, and is a measure of complexing power or metal complex stability. The formation constants for ATA, EDTA, and EDTA-OH as found in the literature are shown in Table III. It is apparent from this table that metal ions are bound more tightly by EDTA than EDTA-OH which, in turn, forms more stable complexes than ATA.

The practical use of chelating agents involves so many different systems varying in pH, ionic strength, oxidizing or reducing strength that it is difficult to predict efficiency upon the basis of either complexing capacity or complex stability. For example, Summersgill *(6)* mentions a number of instances in which ATA fails but EDTA is satisfactory. The calcium complexing capacity of EDTA and EDTA-OH varies with pH and it has been found also that EDTA-OH sequesters ferric iron more efficiently than EDTA in certain alkaline systems. In view of this situation it was felt very desirable to develop practical evaluation tests for the efficiency of chelating agents using conditions closely related to actual textile operations. Many different chelating agents are offered to the textile industry for control of specific metals or for use in specific pH ranges. It is not always convenient for a finishing plant to stock one agent for water softening, another for use in peroxide baths, a third for soda ash scouring, and a fourth for highly alkaline caustic solutions. From the data that will follow it is evident that a balanced product has been developed which meets practically all textile plant requirements.

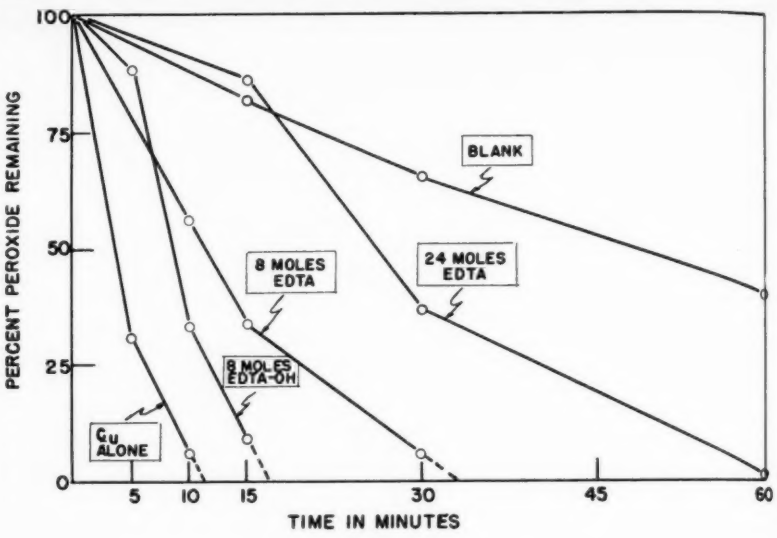


Figure 2

Control of copper in bleach bath (0.25 ppm copper, 180°F)

TABLE I

IMPORTANT WET PROCESSING STEPS

Cotton	*Wool*	*Man-made fibers*
alkaline boil	raw wool scouring	viscose manufacture
peroxide bleach	piece goods scouring	boil-off
mercerizing	fulling	dyeing
dyeing	dyeing	finishing
finishing	finishing	

EFFICIENCY TESTS RELATED TO TEXTILE PROCESSES

CONTROL OF COPPER IN PEROXIDE SOLUTIONS——A wide variety of peroxide bleaching systems are used by the textile industry for cotton, wool, and the synthetic fibers. Sodium silicate (Na_2O 2.5 SiO_2, 42°Bé) is frequently used to stabilize the hydrogen peroxide. One problem, of course, is to prevent precipitation of insoluble silicates in the goods or on the equipment. Another problem is to prevent catalytic decomposition of peroxide by traces of metals such as copper.

In a previous paper *(7)* various organic chelates were compared in efficiency for tying up traces of copper in a typical peroxide bleach bath. The data for both 70°F and 180°F showed that EDTA was more effective than either EDTA-OH or ATA for retarding loss of peroxide in the presence of ¼ ppm of copper. The data for the tests at 180°F are shown in Table IV and illustrated in Figure 2. It is interesting to note that a concentration of ½ to 1 lb of commercial chelate per 100 gallons as recommended for peroxide baths would be 25 to 50 times greater than the 8 to 1 mole ratio used in these tests.

TABLE II

CALCIUM COMPLEXING CAPACITY

	mg $CaCO_3$ per ml		
	Oxalate	*Silicate Hg Titration*	
Chelate A	126	131	127
Chelate B	155	154	151
Chelate C	153	145	164

TABLE III

METAL COMPLEX FORMATION CONSTANTS

	Log K		
Ions	*ATA*[a]	*EDTA-OH*[b]	*EDTA*[c]
Cu^{+2}	12.7	17.4	18.4
Ni^{+2}	11.3	17.0	18.5
Co^{+2}	10.6	14.4	16.1
Zn^{+2}	10.5	14.5	16.2
Cd^{+2}	9.5	13.0	16.5
Fe^{+2}	8.8	11.6	14.2
Mn^{+2}	7.4	10.7	13.5
Ca^{+2}	6.4	8.0	10.6
Fe^{+3}	15.9[d]		25.1[a]

a) Schwarzenbach, G, and Freitag, E, *Helv Chim Acta* 34, 1492 (1951) T = 20°C 0.1 N KCl soln.

b) Charberek, S, and Martell, A E, *J Am Chem Soc* 77, 1497 (1955) T = 29.6°C, 0.1 N KCl soln.

c) Schwarzenbach, G, and Freitag, E, *Helv Chim Acta* 34, 1503 (1951) T = 20°C, 0.1 N KCl soln.

d) Schwarzenbach, G, and Heller, J, *ibid* 34, 1889 (1951) T = 20°C, 0.1 N KCl soln.

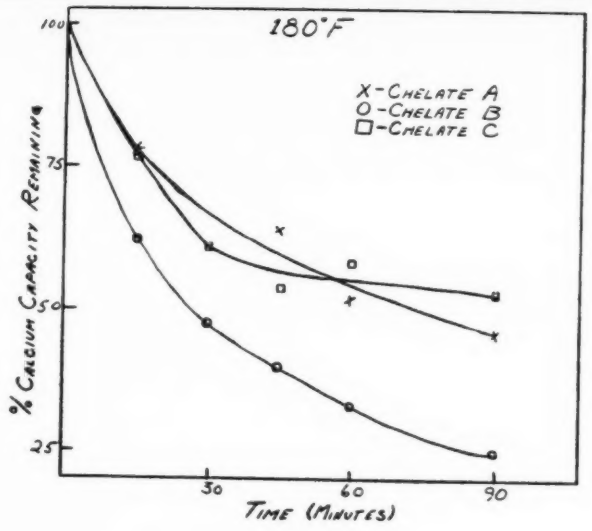
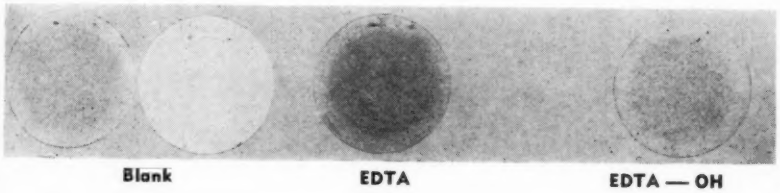


Figure 3
Effect of H_2O_2 on calcium chelating capacity



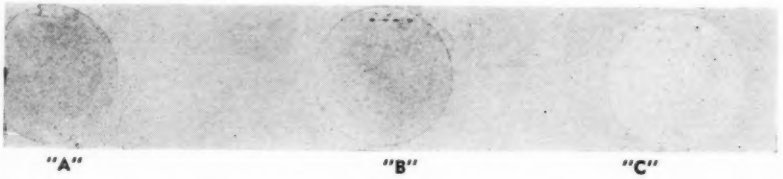


Figure 4
Control of Ca^{++} and Fe^{+++} in 1% NaOH, 160°F

TABLE IV
CONTROL OF COPPER IN PEROXIDE BATH
(0.25 ppm Cu^{+2}; Temp 180°F)

Mole ratio agent/metal	Chelating agent	Percent peroxide remaining				
		5 min	10 min	15 min	30 min	60 min
Blank (Cu^{+2} only)	—	—	—	82	65	40
24	EDTA	31	6	0	—	—
8	EDTA	—	—	86	37	1
8	ATA	—	56	34	6	0
8	EDTA-OH	70	41	17	0	—

TABLE V
EFFECT OF PEROXIDE ON CHELATING AGENTS AT 180°F

Agent	Percent calcium capacity remaining					
	0 min	15 min	30 min	45 min	60 min	90 min
Chelate A	100	78	64	64	52	46
Chelate B	100	62	48	40	33	25
Chelate C	100	77	61	54	58	53

In order to determine whether the less effective chelates were affected by the peroxide or merely failed to tie up copper sufficiently, a similar test was made to check residual calcium complexing capacity. In this case, however, it was necessary to use much larger quantities of chelating agent, approximately 2%. The data for these tests are shown in Table V and illustrated by the curves in Figure 3. The results indicate that peroxide destroys more chelating capacity in the case of the EDTA-OH type product than it does for either the commercial EDTA chelate or the balanced chelate. It is reported in the literature that certain chelates accelerate peroxide decomposition even in the presence of sodium silicate *(1)*.

CONTROL OF IRON IN ALKALINE SOLUTIONS——Iron is one of the most troublesome ions encountered in textile processes. Ferric iron seems to be readily absorbed by fabrics or fibers and in alkaline systems it forms the highly insoluble ferric hydroxide. Prevention of iron stains is quite important in various scouring and bleaching operations. Iron also exhibits an adverse effect in many dyeing operations.

It was reported previously *(7)* that chelating agents could be compared for efficiency in controlling iron in various alkaline baths by a simple filter-paper technique. The data involved tests of solutions containing 1 ppm iron as Fe^{+3}. This work has now been extended to include solutions containing 40 ppm calcium (calculated as $CaCO_3$) and 1 ppm of Fe^{+3}, which represents a condition more likely to be encountered in actual textile processes. This filter-paper test has been found useful by other workers in the field *(8)*.

The technique is quite simple as shown by the following example: A solution of 1% NaOH is prepared containing 40 ppm Ca^{+2} as $CaCO_3$ and 1 ppm Fe^{+3} using stock solutions of $CaCl_2$ and $FeCl_3$. Sufficient chelating agent is added to sequester all the calcium (cf Table II) plus 10% excess. The solution is heated at 160°F for 30 minutes, cooled, and then filtered through a 4.25-cm white filter paper in a Büchner funnel. After the filter paper has dried, its reflectance is measured using a Photovolt reflectometer with a blue tristimulus filter. All tests are run in triplicate.

The three alkaline baths used in this series of tests were 1% NaOH, 1% Na_2CO_3, and 1% NaOH plus 0.1% sodium silicate. The 1% NaOH is representative of many dyebaths, 1% Na_2CO_3 is typical of many scouring operations, while the NaOH-silicate mixture represents a cotton kier boiling system. This solution was heated to the boil for 30 minutes instead of

being kept at 160°F.

Figure 4 illustrates the filter papers obtained in this type of test. The paper used for filtering the solution without calcium or iron is barely visible while the blank containing no chelating agent is a distinct reddish brown. The papers representing Chelate A and Chelate B are essentially the same as the blank while the paper representing Chelate C is almost white.

The data obtained for the 1% NaOH solution is illustrated by the bar graph in Figure 5.

It is quite apparent that only the balanced Chelate C was effective under these conditions. Both EDTA and EDTA-OH fail to prevent iron hydroxide formation in this highly alkaline system. Gluconic acid is quite effective in preventing iron precipitation in this system although it has no calcium sequestering action.

The data obtained for the 1% sodium carbonate solutions is illustrated by Figure 6. In this system EDTA-OH and the balanced chelate are effective whereas EDTA does not control iron. It might be mentioned that the fineness of the $Fe(OH)_3$ which forms varies with the system and affects the reflectance value of the filter paper. It is not difficult, however, to distinguish between an effective and an ineffective chelating agent.

The results obtained with the mixture of sodium hydroxide and sodium silicate were quite similar to the results with sodium hydroxide. Only Chelate C was effective as shown by the graphs in Figure 7.

It is interesting to note that the actual amount of chelating agent used in these tests was about 1/3 lb per 100 gallon in the case of Chelate C. This is somewhat less than the amounts normally recommended.

As regards the accuracy of this filter paper test, the data were evaluated statistically. The least significant difference (LSD) for a 95% probability level was 4.8 reflectance units. However, the differences between effective and ineffective agents are much greater than 4.8 units as shown by the data in Table VI.

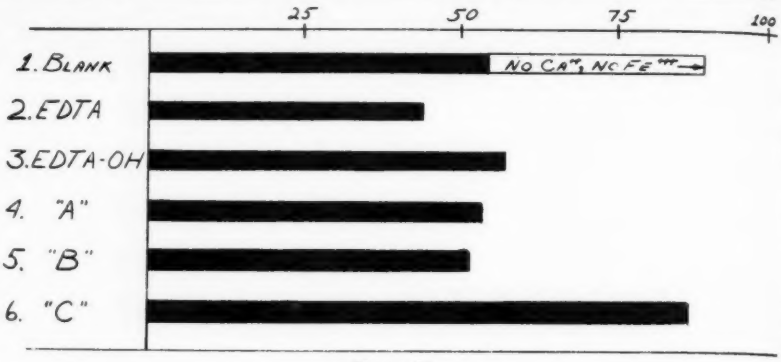


Figure 5

% Reflectance of filter paper
40 ppm $Ca(CaCO_3)$, 1 ppm Fe, 1% NaOH
160°F

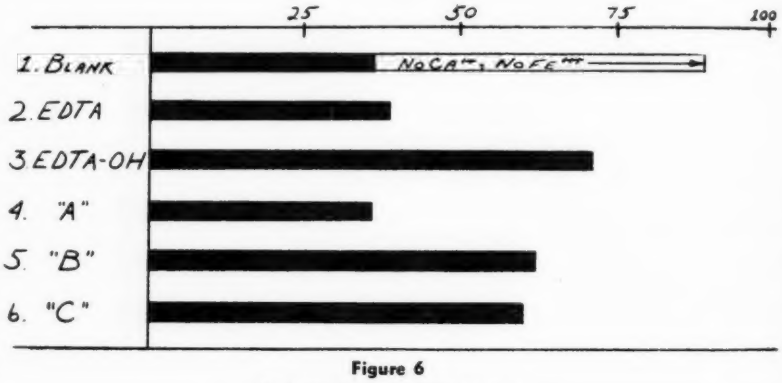


Figure 6

% Reflectance of filter paper
40 ppm $Ca(CaCO_3)$, 1 ppm Fe, 1% Na_2CO_3
160°F

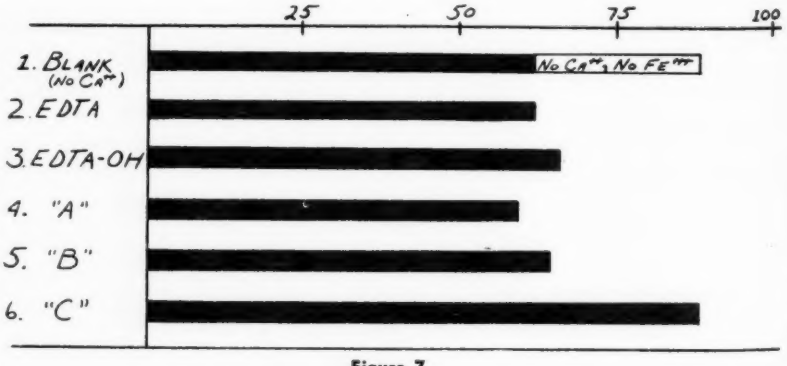


Figure 7

% Reflectance of filter paper
40 ppm $Ca(CaCO_3)$, 1 ppm Fe, 1% NaOH, 0.1% silicate
212°F

IRON PICKUP BY DIFFERENT FORMS OF CELLULOSE——In an effort to relate the iron control tests described above more closely to textile processing, a brief study was made to compare iron pickup by different forms of cellulose. Cloth circles of bleached Indianhead were cut out corresponding to the 4.25 cm on filter papers. These weighed about 0.25 grams. Portions of the same fabric were chopped with a Wiley Mill using a coarse and medium screen. A commercial cotton flock, a commercial rayon flock, and a bleached wood pulp were included in the tests.

The iron control tests using 1% soda ash containing 40 ppm calcium and 1 ppm iron were repeated by adding the cloth circles or 0.25 grams of the other forms of cellulose to the solution prior to heating for 30 minutes at 160°F. The solutions were cooled and filtered as usual. The data obtained in this series of tests are shown in Figures 8 and 9.

Although a marked discoloration of the fabric circles and chopped fiber pads was evident, the differences between the blanks with no chelating agent and the blanks with no calcium or iron were not as great as in the case of the filter paper alone. Furthermore it was noted that the filter papers beneath the chopped fiber pads

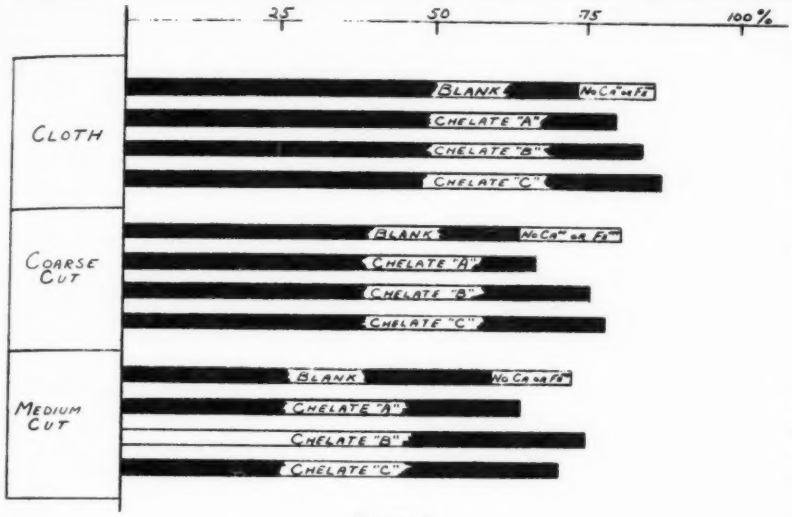


Figure 8

Comparison of iron pickup in Na_2CO_3
Reflectance

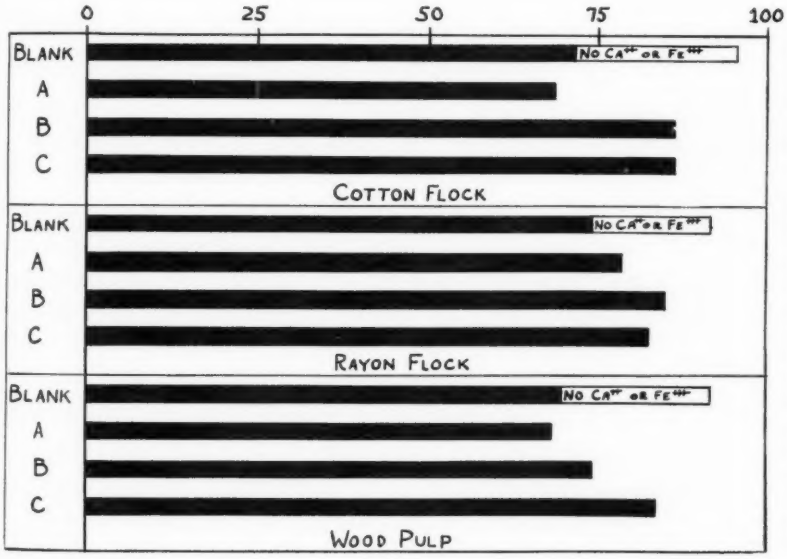


Figure 9

Comparison of iron pickup
(40 ppm Ca^{++} as $CaCO_3$, 1 ppm Fe^{+++}, 1% Na_2CO_3, 160°F)

TABLE VI

CONTROL OF IRON AND CALCIUM
(40 ppm Ca^{+2} as $CaCO_3$, 1 ppm Fe^{+3}; 30 min at 160°F)

	Reflectance of filter paper		
Agent	*1% NaOH*	*1% Na_2CO_3*	*1% NaOH* 0.1% Na_2SiO_3*
None	54	36	62
EDTA	44	38	62
EDTA-OH	57	71	66
Gluconic Acid	90	—	—
Chelate A	53	36	58
Chelate B	52	62	64
Chelate C	86	60	88
No Ca^{+2} or Fe^{+3}	88	88	88

* 30 min at boil

were stained indicating that not all of the ferric hydroxide had been absorbed from the solution.

The data show that the fabric discs or various forms of cellulose can be used to measure chelating agent performance. The filter paper test is preferred, however, because it provides the greatest difference in appearance and reflectance values between effective and ineffective chelating agents.

SUMMARY AND CONCLUSIONS

The complexing capacity as measured by titration with calcium or the complexing power as indicated by formation constants cannot be used to determine the efficiency of organic chelating agents in many textile processes. It is possible, however, to compare chelating agent efficiency by means of simple laboratory tests using conditions simulating actual textile operations.

The efficiency of chelating agents in peroxide bleach baths can be determined by measuring loss of peroxide and loss of calcium complexing capacity at elevated temperatures. The marked catalytic action of copper on peroxide can be controlled more effectively with EDTA than with EDTA-OH. The former also shows better stability in peroxide.

The relative efficiency of chelating agents for controlling iron in various alkaline solutions can be determined by a simple filtration test. Visual inspection or reflectance measurements can be used to note the amount of ferric hydroxide formed under different conditions. EDTA is not effective for control of iron in either caustic soda or soda ash. EDTA-OH is effective in soda ash but fails in caustic soda. A balanced chelate, however, is effective in both of these systems as well as a caustic-silicate solution.

Fabric discs, chopped cotton fibers, or other forms of finely divided cellulose or flock may be used in place of a filter paper for determining the relative efficiency of chelating agents. These other forms of cellulose do not exhibit the same spread in reflectance values and the filter paper test is preferred because it is more precise and more accurate.

A balanced chelating agent has been developed which seems to meet all requirements of the textile industry for control of hard water and trace metal ions.

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QUESTIONS AND ANSWERS

(All questions answered by Dr Gantz except where noted).

QUESTION: I did not hear the early portion of this paper, but I wonder if there was any report on the recommended type of chelating agents on the acid side for iron?

ANSWER: We did not make any tests on the acid side in this work, but, of course, if you are worried about calcium in an acid solution, that is a tough question. If you are worried about iron in acid solution, let me assure you that most of these materials chelate iron very effectively on the acid side.

Q: Would that be true down to strong acid solutions, like pH 1?

A: No. We are still looking for good chelating agents in strong acid.

Q: If the chelating material did not do an efficient job of chelating calcium in the presence of iron, would it show up well, inasmuch as calcium gives a white pigment which would tend to offset the color of the iron pigment?

A: We were only trying to show control of iron, and we put calcium in the bath because we thought that was a likely situation.

As I mentioned, gluconic acid, which has no value for calcium, was an excellent chelating agent for control of iron in the system that we used.

Q: I was thinking that, if the calcium were deposited on the filter paper, any calcium carbonate, hydroxide, or silicate, you would have a white pigment which would tend to offset the color of the iron pigment. So, if a chelating agent did not keep the calcium in the solution, then it would look better as far as chelating the iron.

A: There isn't any calcium precipitate formed in these tests. Furthermore, if calcium carbonate or calcium silicate was formed the iron would still show up, because, when we put this chopped fiber in there, we had that iron spread out all over this mass of fiber, and that is why the reflectance wasn't as low as in the case of filter paper, where the iron was all down on the top surface.

I still think that, if you had a white calcium precipitate, you would have no trouble seeing that one part per million of iron as iron hydroxide.

Q: Would the difference in the chelating properties of the various agents that you tested have any relationship to their selectivity of their metallic chelating power? Would one type select a metallic ion in preference to another metallic ion of the solution?

A: The materials do exhibit preferential chelation, but I do not believe that was a factor in this work because we had only copper in one case, and iron and calcium in the other case. Of course, iron is sequestered before calcium.

If we had not had enough chelating agent to control all of the calcium, that might be an interesting test. However, we did not do that.

One of the things that we were trying to show here was progress in eliminating the wide variety of chelating agents that are offered to the textile industry, and getting one that will work under all conditions.

Q: In your work have you found any difference in the chelating value of these various EDTA compounds on irrigated cotton as against delta or upland cotton?

A: No, we have not checked the effect of these materials on various raw cottons.

Q: It has been reported in previous work that irrigated cotton contained a much higher percentage of iron, which, it was indicated, might be more difficult to control.

A: That could be true. Certainly in the case of soil there is some in which iron is bound, and chelating agents will not take it out; there is something in certain soils that holds iron more strongly than a chelating agent.

Q: You mentioned the use of gluconic acid. I was wondering how acid, such as citric, would be compared to the use of EDTA or modified types of that?

A: We did not run any tests on citric acid. I am sorry that Dr Chiddix is not here, for I know that he did some work earlier on citric acid under these conditions. I believe he found that it was effective in one of these solutions.

A: Emil Hansen (Antara Chemicals): We found that citric acid was about as effective as gluconic acid.

Q: I would like to bring out a point, referring to the paper by Easton and Feldmann.* It concerns the use of phosphates and the calcium salts to replace the silicates. How would that be affected by the chelating agents described?

A: Bernard K Easton (Becco Chemical Div, Food Machinery and Chemical Corp): We would have to be very careful in using chelating agents in the peroxide solution with the phosphate formulation, because we are depending upon calcium phosphate as our stabilizing agent. If we use a chelating agent and tie up the calcium, we will lose our stabilization.

(* EDITOR'S NOTE: "Continuous Bleaching of Cottons with Silicate-free Peroxide Solutions", *Am Dyestuff Reptr* 44, No. 22, P745-8 (October 24, 1955)).

However, we have run a few experiments in the laboratory at Buffalo. My information is limited because we have run only a few. This is what we have done: If we think there are conditions coming up where it might be advantageous to use a chelating agent in the peroxide solution, we do it by adding enough excess calcium to form our calcium phosphate above the amount of calcium that will be tied up by the chelating agent. We have done that, and we think the results are satisfactory.

As I understand it, the fact that the chelating agent will tie up the calcium will still not destroy the properties of the chelating agent to take care of iron or copper or whatever happens to be there. However, it is highly important, if you are going to use a chelating agent, to handle it very carefully and control it. And it will be absolutely necessary to add an excess amount of calcium to the solution.

A: Paul Feldmann (Dan River Mills, Inc): May I point out that fabrics contain several thousand parts, at least, of calcium and magnesium, so it would take a tremendous amount of sequestering agent to have enough to sequester all the calcium and magnesium.

A: (Dr Gantz): As Mr Easton mentioned, if you have one to two thousand parts per million of calcium and magnesium hardness coming from the cloth into this system, and you are using chelating agents to tie up cobalt or nickel or copper, they will be effective at low concentrations, because the formation constants for cobalt, nickel, and copper are so much higher than for calcium. In other words, these materials would just barely tie up calcium, so calcium oxalate cannot precipitate.

But in the case of copper, the chelating complex is much more stable, and even though there is plenty of calcium or magnesium there, that will not interfere with its controlling copper and other ions which are more tightly bound.

Q: Why use an excess of sequestering agent in your experiment?

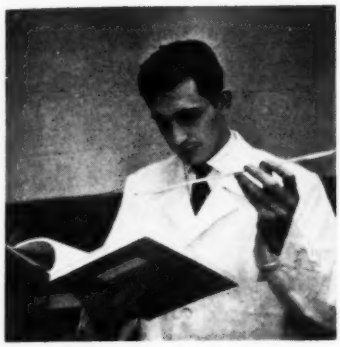
A: (Dr Gantz): We wanted to soften the water. Our problem was to tie up all the calcium and magnesium and use an excess to tie up the iron, too. I think we could make some very critical experiments in the future knowing what we do now about the nonsilicate system of bleaching outlined by Mr Easton in his paper.

Incidentally, it may be of interest to note that, when we used iron in this peroxide stability test, it did not catalyze the decomposition of peroxide. Presumably, it formed ferric hydroxide, which is as fully and firmly tied up as any chelate could tie it up. It did not have any appreciable catalytic effect on peroxide.

NNE Section—LTI Student Chapter——

WOOL DYEING — EFFECT OF DYE AND ACID VALENCE*

JOSEPH B LEVY**



Levy

When wool is dyed with acid dyes, it is expected that the rate of dyeing will be affected by the valence of the dye and of the acid used in the dyeing process. The author has examined the effect of varying dye and acid valence on the rate of dyeing. The experimental technique is described, and the results obtained are shown to agree closely with predictions made from theory.

INTRODUCTION

THE process of dyeing wool with acid dyes has been studied carefully by various workers, who have considered each of the many variables encountered in the process. Among these variables are the effects of temperature, agitation, dyebath composition, and form of the substratum. Most of this work, however, was done on the equilibrium conditions of the dyeing, rather than on the rate.

It is believed that the dyeing of acid dyes on wool takes place in two stages. First, the acid is very rapidly adsorbed by the wool at the salt linkages, and second, the acid anion is replaced comparatively slowly in the wool by the dye anion. This is shown in Figure 1.

The purpose of the present work was to investigate the effect of varying the valence of the dye and of the acid used, on the rate of dyeing, keeping other variables constant. With this in mind, two level-dyeing acid dyes were chosen, one of which had a single sulfonic acid group present; the other had two sulfonic acid groups. Figure 2 shows the *Colour Index* numbers, empirical formulas, structural formulas, and trade names of the two dyes used.

By purifying these dyes, and using each of them to dye wool, first with a monovalent acid and a monovalent salt, and second with a divalent acid and a divalent salt, and by keeping all other variables constant, one should be able to show the effect of varying the dye and acid valence on the rate of dyeing.

PROCEDURE

For this investigation, medium quality wool sliver was used, after being scoured with Nonic 218, a nonionic synthetic detergent of the polyethylene glycol tert-

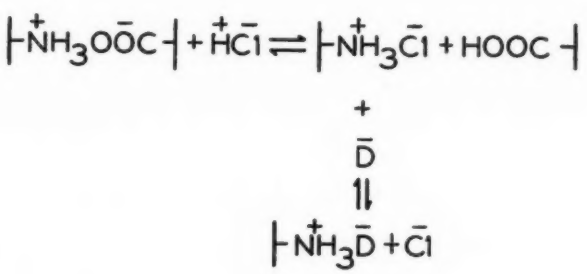
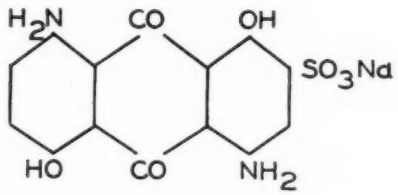


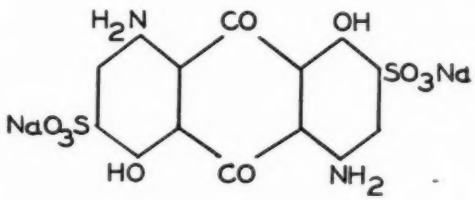
Figure 1

I. C I 1053 $C_{14}H_9N_2O_7SNa$



CALCOCID ALIZARINE BLUE SE

II. C I 1054 $C_{14}H_8N_2O_{10}S_2Na_2$



CALCOCID ALIZARINE BLUE SAPX

Figure 2

* Presented at the Lowell Technological Institute in April, 1954. The work is part of a Master's thesis and was carried out at LTI under the direction of Prof John H Skinkle.

** Research Fellow, Textile Research Institute, Princeton, N J.

dodecylthioether type. Previous work with Nonic 218 has shown that it removes oil and grease as efficiently as does solvent extraction, and that it rinses out of the material completely.

The scoured wool was allowed to condition, was cut into lengths of one-eighth to one-quarter inch, and was kept in the conditioning room for later use in dyeings. Each of the two dyes was purified by the method of repeated salting out with sodium acetate, the excess sodium acetate being extracted with portions of boiling 95% ethanol. This method has been described in the literature a number of times, and has been found by various workers to yield highly purified dyestuffs.

The dyeings were carried out in a three-necked flask of 1000-ml capacity. Constant agitation was provided by a stainless-steel stirrer, and a reflux condenser was used to keep the dyebath ratio constant. The flask was immersed in a constant-temperature water bath throughout.

In each case, 5 g dry wool were dyed in 500 ml of dyebath containing 0.006 moles/liter of dye, 0.004 moles/liter of acid, and 0.012 moles/liter of salt. These amounts were chosen because they closely approximate the commercially used concentrations of 2% dye, 3% acid, and 15% salt.

Four dyeings were carried out, each being done in triplicate, as follows:

1) Monovalent dye, monovalent acid, monovalent salt.
2) Monovalent dye, divalent acid, divalent salt.
3) Divalent dye, monovalent acid, monovalent salt.
4) Divalent dye, divalent acid, divalent salt.

The acids and salts used were hydrochloric acid and sodium chloride, sulfuric acid and sodium sulfate.

At given intervals, samples of the dyebath were withdrawn and their transmission measured on the Cenco photoelectric colorimeter. From previously prepared calibration curves, the dyebath exhaustion at each time interval was found.

RESULTS

From the results obtained, the following factors were measured:

Equilibrium Exhaustion: This is expressed as percent of original dye removed from the dyebath, and is the maximum removed under the conditions of dyeing.

Time of Half Dyeing: This is the time taken by the material to exhaust half the amount of dye it exhausts at equilibrium. This factor is used as a measure of the over-all rate of dyeing.

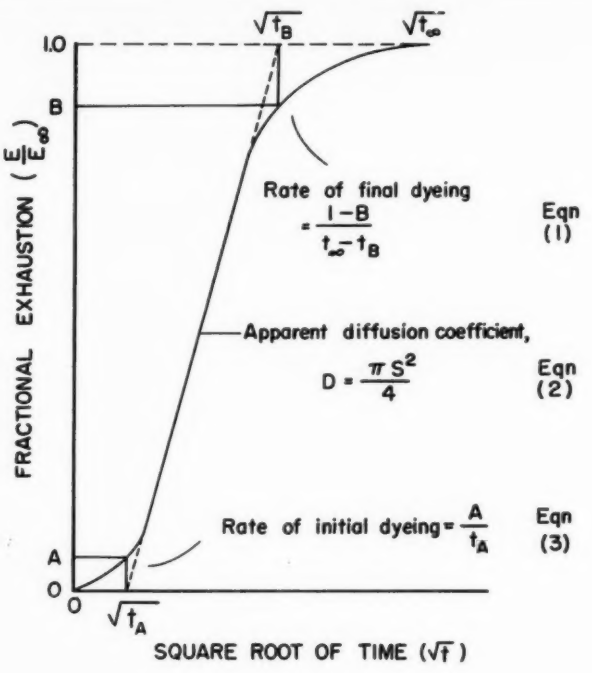


Figure 3
Typical fractional exhaustion vs square root of time curve

Apparent Diffusion Coefficient: This can be found from an approximation of Fick's equation for diffusion in a steady state, which has been found by Speakman and Smith to be applicable to the dyeing of wool with acid dyes. A plot of the fractional exhaustion (E/E_∞) against the square root of time should have a straight-line portion for the duration of the diffusion dyeing. From the slope of this straight-line portion, the apparent diffusion coefficient can be determined from the equation:

$$D = \frac{\pi S^2}{4},$$

Where D is the apparent diffusion coefficient and S is the slope of the straight-line portion. This coefficient is used as a measure of the rate of diffusion of the dye into the fiber during the period of diffusion dyeing.

Initial Dyeing Rate: This is an approximation to the rate of dyeing in the early stages of the process, before diffusion dyeing begins.

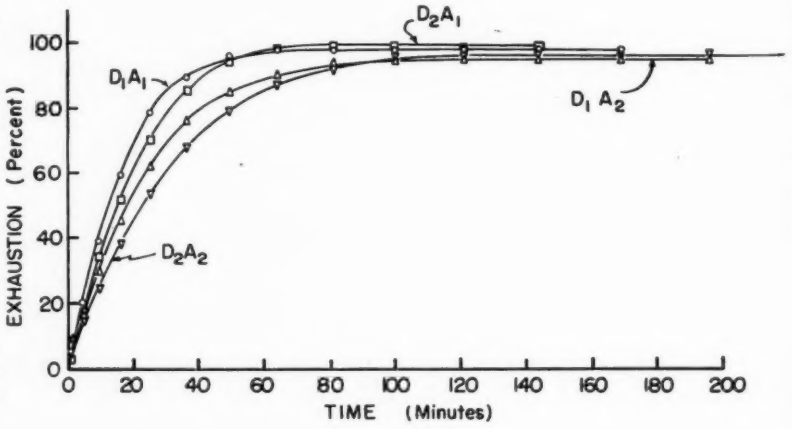


Figure 4
Exhaustion vs time

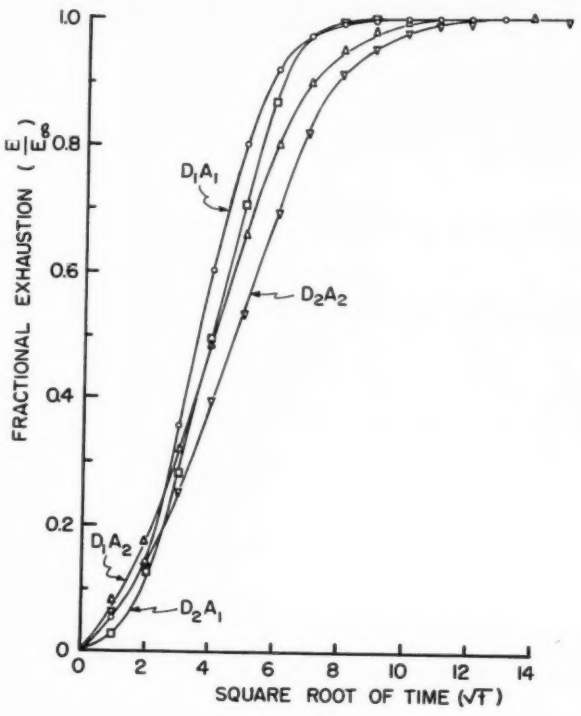


Figure 5
Fractional exhaustion vs square root of time

Final Dyeing Rate: This is an approximation to the rate of dyeing in the final stages of the process, after diffusion dyeing has finished.

Figure 3 shows a typical plot of fractional exhaustion versus the square root of time. If the straight-line portion of the curve is extrapolated at either end, as shown, two values of the square root of time ($\sqrt{t_A}$ and $\sqrt{t_B}$) are obtained If the actual values of fractional exhaustion (A and B) at these values of the square root of time are found, it is possible to calculate: a) the rate of final dyeing, from equation 1; b) the apparent diffusion coefficient, from equation 2; and c) the rate of initial dyeing, from equation 3.

Table I is a sample table of results obtained from one dyeing. It can be seen that the reproducibility of the results is very good, the average standard error being found to be ± 0.04.

The dyeing process was assumed to have reached equilibrium when the dyebath exhaustion was found to be the same for three consecutive, fairly large time intervals. It should be noted that the time intervals were chosen so that the square root of time would give consecutive numbers, starting with unity.

Figure 4 shows the results of the four dyeings plotted as percent exhaustion against time in minutes. The letters and numbers used to identify the curves refer to the valences of the dye and acid used in that particular dyeing. For example, D_1A_2 signifies monovalent dye and divalent acid. It is noted that in each case the two curves obtained, using the same acid, are close to each other, and that for each pair of curves there is a crossover. For any one acid, until the point of crossing of the curves is reached, the dye of lower valence has the greater rate of dyeing; after the crossover, the dye with the higher valence eventually exhausts more.

Figure 5 shows the results of the four dyeings plotted as fractional exhaustion against the square root of time. It should be noted that, when the same acid is used, the curves are parallel in the straight-line portions.

Table II shows the calculated results, which are discussed below.

INITIAL RATE OF DYEING——It can be seen that the two highest values are obtained with the divalent acid, the two lowest ones with the monovalent acid. But, for any one acid, the higher rate is obtained with the monovalent dye.

DIFFUSION RATE OF DYEING——Here the two highest values are obtained with the monovalent acid, the two lowest ones with the divalent acid. For any one acid, the higher rate is obtained with the monovalent dye. It is believed, however, that the differences between dyes may be within experimental error.

FINAL RATE OF DYEING——The highest values are obtained with the monovalent acid, the lowest with the divalent acid. For any one acid the rate is seen to be the same, and is therefore independent of the valence of the dye used.

TABLE I

D_1A_2

Time (mins)	$\sqrt{t}$	% Exhaustion 1	2	3	Mean	E/E_∞
1	1	8.0	8.0	8.0	8.0	0.083
4	2	20.0	18.5	20.0	19.5	0.203
9	3	30.0	30.0	30.0	30.0	0.313
16	4	47.0	47.0	47.0	47.0	0.490
25	5	62.5	62.5	62.5	62.5	0.652
36	6	76.0	76.5	76.5	76.3	0.795
49	7	84.7	85.0	85.0	84.9	0.886
64	8	90.7	90.7	90.7	90.7	0.946
81	9	93.0	93.0	93.2	93.1	0.971
100	10	94.7	94.7	95.0	94.8	0.989
121	11	95.8	95.5	95.7	95.7	0.998
144	12	96.0	95.7	96.0	95.9	1.000
169	13	96.0	95.7	96.0	95.9	1.000
196	14	96.0	95.7	96.0	95.9	1.000

TABLE II

	D_1A_1	D_1A_2	D_2A_1	D_2A_2
Initial rate of dyeing	0.045	0.100	0.033	0.059
Diffusion rate of dyeing	0.041	0.021	0.037	0.017
Final rate of dyeing	0.0014	0.0009	0.0014	0.0007
Time of half dyeing	12.25	16.81	16.40	22.6
Equilibrium exhaustion	98.8	95.9	99.5	96.75

TABLE III

COMPARISON OF THEORETICALLY DERIVED WITH EMPIRICALLY DERIVED RELATIONSHIPS

Parameter	Theoretical	Empirical
Time of half dyeing	$t_{1/2} = k(xy)^n$	$t_{1/2} = 11.6(xy)^{1/2}$
Initial rate of dyeing	$R_i = k(y^n/z^m)$ $(n > m)$	$R_i = 0.047\ (y/z^{1/2})$
Diffusion rate of dyeing	$D = k/y$	$D = 0.039/y$
Final rate of dyeing	$R_f = k/y$	$R_f = 0.0014/y$
Initial time lag	$t_a = k(z^m/y^n)$ $(n > m)$	$t_a = 2\ (z^{1/2}/y)$

$t_{1/2}$ = time of half dyeing
R_i = initial rate of dyeing
D = apparent diffusion coefficient
R_f = final rate of dyeing
x = valence of the dye
y = valence of the acid
k,n,m = constants

TIME OF HALF DYEING———As was mentioned above, this parameter is used as a measure of the over-all rate of dyeing. It should be noted that the highest rate (or lowest time of half dyeing) is obtained when both acid and dye are monovalent, the lowest rate when both are divalent, and intermediate and equal rates in the other two cases.

EQUILIBRIUM EXHAUSTION——— The two highest values are obtained with the monovalent acid, the two lowest with the divalent one. However, for any one acid, the divalent dye is seen to exhaust more than the monovalent one.

From a theoretical analysis of the results, certain relationships were derived which would be expected to hold over the different sections of the dyeing curve. Some empirical relations were worked out from the results and were compared to the theoretically derived ones. This comparison is shown in Table III. Table IV shows a comparison of observed results with calculated results, and it can be seen that there is very good agreement.

TABLE IV

	D_1A_1	D_1A_2	D_2A_1	D_2A_2
Calc $t_{1/2}$	11.6	16.4	16.4	23.2
Obs $t_{1/2}$	12.3	16.8	16.4	22.6
Calc R_1	0.047	0.094	0.033	0.066
Obs R_1	0.045	0.100	0.033	0.059
Calc R_2	0.039	0.019	0.039	0.019
Obs. R_2	0.041	0.021	0.037	0.017
Calc R_f	0.0014	0.0007	0.0014	0.0007
Obs R_f	0.0014	0.0009	0.0014	0.0007

CONCLUSION

In conclusion, this work has shown that:

1) The valence of the dye anion and the valence of the acid anion both have an effect on the rate of dyeing of acid dyes on wool.

2) In general, the effect of the acid valence is a more important factor than that of the dye valence.

3) The greatest dye exhaustion at equilibrium is obtained when the ratio of dye valence to acid valence is greatest.

4) The highest rate of dyeing is obtained when the product of dye valence and acid valence is lowest, that is, in cases when both are monovalent.

5) Predictions from theory as to what should occur during the various periods of duration of dyeing are found to agree closely with the observed results.

6) The mechanism, as indicated by the theory, is essentially a diffusion process of dye into fiber. This diffusion is resisted due to the fact that, as the dye anions penetrate into the fiber, they must pass ionized amino groups to which they are attracted.

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MEMBERSHIP APPLICATIONS

March 23, 1956

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John R Fallon—Tech service repr, text resins, Monsanto Chem Co, Springfield, Mass. Sponsors: S F Sylvester, F C Donofrio.

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NNE Section—LTI Student Chapter——

EFFECT OF DYE STRUCTURE ON THE DYEING OF ORLON 42—AZO DYES*

A J PELLETIER

From a study of the structure of mono-azo and dis-azo dyes used on Orlon 42, the author concludes that:

1) In general increases in molecular weight increase the dye affinity in acid dyebath but not in salt. The manner in which the increase is made is also important.

2) In general, the presence of sulfonic acid groups prevents dye absorption in the mono-azo dyes, although it is still possible that the dye will still have considerable affinity if the sulfonic acid groups are properly positioned in the molecule.

3) With dis-azo dyes, as the number of sulfonic acid groups is increased from one, the salt dyebath exhaustion decreases towards zero, and the acid dyebath decreases to a variable degree depending on the dye.

4) The behavior of hydroxyl groups in the dyeing of acrylonitrile is not clear cut.

5) Amines present in a dye molecule either alone or in excess of sulfonic acid groups will facilitate the dyeing of Orlon 42.

INTRODUCTION

THE properties of the chemical constituents used in the manufacture of the new man-made fibers make many of these fibers very difficult to dye by conventional methods. The reasons that some of them cannot be dyed well may be summarized as follows:

1) The lack of reactive groups in the polymer, either in the form of specific sites or hydrogen-bonding sites.
2) The lack of sufficient noncrystalline volume which would allow a dye molecule to occupy the interior of the polymer.
3) The possession by the polymer of high electric charge of the same sign as the dye ions.
4) Excessively slow rate of diffusion of dyes into the fiber because of the high degree of orientation in the fiber molecules.

In all too many cases the approach to the problems encountered in dyeing of the man-made fibers has been made along standard lines. Many investigators try to apply available dyes by methods which have been found to dye the established fibers; then, if the need arises, they alter the dyeing procedure to increase dye affinity. Or they may attempt to effect variations in the fiber itself. Of the many variables that can be investigated in the application method, four can be singled out as being the most prominent:

1) Variation of polymer structure
2) Use of fiber mordants
3) Pressure dyeing at high temperature
4) Addition of swelling agents

In each one of the preceding methods some drawback can be found which either degrades the fiber or the dyes used or increases the final cost of the entire dyeing process. The need for a new avenue of investigation, which would eliminate (or at least decrease) these undesirable effects, is apparent.

Very little work involving the investigation of the dyes being used and their effect on dyeing has been published. The purpose of this current work was to study the effect of dyes by investigating their chemical constitution in relation to their affinity for a man-made hydrophobic fiber, namely Orlon 42.

It is our belief that, if a selection of dyes with predetermined variations in structure is made from the *Colour Index*, and if suitable controls are provided so that such variables in dyeing as temperature, agitation, dyebath volume and dyeing assistants are kept constant, the effect of such things as basic structure of dyes, attached groups, molecular weight and ionic charge can be studied without reference to what class the dyes belong, or to what methods are normally used for application.

Ideally, chemical constituents found to have affinity for a particular fiber should be built into the structure of new dyes for that fiber. These dyes would then have high affinities and would in many cases eliminate the use of swelling agents, fiber mordants, pressure dyeing and polymer modification. The only outside assistants that might be necessary would be a salt or an acid.

It has been shown in several previous investigations that, when the application of dyes to new man-made fibers is undertaken by class, ie, direct, acid, etc, the results are not always impressive, although a study by the Northern New England Section, AATCC *(1)* led to the conclusions that 1) disperse dyes have affinity for Dynel, Dacron, Acrilan, Orlon, acetate and nylon, 2) many of the basic colors had good affinity for only some of the fibers, and 3) the acid dyes had affinity for fewer of the fibers. Generally, however, it can be said that no "class" will successfully dye all the man-made fibers. Dyes within each class will vary in their affinities.

In the aforementioned investigations, examination of the dyes which did show some dyeing power revealed some correlation between the extent of exhaustion and the dye structure. Comparison of affinities is difficult, however, because the method of application used for each dye varied with the class of dye used; the results, however, do indicate trends.

It is the objective of this paper to suggest means for eliminating differences in application procedures and to obtain more positive correlation between organic structure and dye exhaustion.

The selection of Orlon 42, stated to be an acrylonitrile-2-vinyl pyridine copolymer, as the fiber to be used in this study was for two reasons.

1) Orlon 42 is a fiber in commercial production, and its dyeing problems are of immediate concern to the industry.

2) Orlon 42 is probably the most difficult to dye of all the staple man-made fibers, in spite of the polymer modification. It is believed that a solution of the dyeing problem on Orlon would also solve the problem of dyeing the other man-made fibers that are similar in chemical nature.

EXPERIMENTAL PROCEDURE

Orlon 42 was scoured (so as to remove any processing oils present) and then cut into lengths of ¼ inch (so as to eliminate variations in the rate of dye exhaustion due to structural variations of the material being dyed).

The dyeings were conducted for one-hour and eight-hour periods with only sodium chloride present as assistant, and for one-hour and eight-hour periods with only hydrochloric acid present. The same dye was used in each case, making it

* This paper is a condensation of a thesis performed by the author, under the direction of Prof John H Skinkle, for the degree of Master of Science at Lowell Technological Institute. It was presented at the Lowell Technological Institute on April 22, 1955.

necessary to conduct four dyeings for each dye selected. One-gram samples of Orlon 42 were used for each dyeing. The dye concentration was 2% (owf) with a dyebath ratio of 100:1, and a temperature of 100°C. The concentration of NaCl and HCl was 30% and 4% (owf) respectively. These high concentrations of acid and salt were used to assure that any change that might occur in the affinity of the dye at various lower concentrations would be included in the dyeings.

The dye exhaustion in each bath was determined from a calibration curve of the transmission of solutions of known concentrations. The Coleman Junior Spectrophotometer was used to measure the transmission values.

RESULTS[1]

[1] The results given here cover only data obtained from mono-azo and dis-azo dyes. Therefore, the number of dyes covered represents only a fair percentage of the total dyes yet to be investigated.

Reference is made only to dye absorption with no consideration being given to such things as fastness, leveling power, etc. Although many of the exhaustions are low, it is the change in affinity which is regarded as important.

TABLE I
EFFECT OF DYE STRUCTURE ON EXHAUSTION

Figure No.	MW	% exhaustion: salt 1 hr	salt 8 hrs	acid 1 hr	acid 8 hrs
1a	350	0	0	0	0
1b	400	1	3	9	12
2a	556	0	4	1	4
2b	584	0	0	13	15
3a	452	3	3	1	1
3b	556	2	3	6	7
4a		4	6	4	6
4b		3	3	1	1
5a		68	70	70	86
5b		0	0	0	2
6a		0	4	1	4
6b		2	3	6	7
7a		2	3	6	8
7b		0	0	0	0
8a		0	0	0	0
8b		10	25	60	70
9a		0	0	0	0
9b		4	4	5	5
10a		68	70	70	86
10b		6	15	16	38
11a		74	81	81	88
11b		62	72	71	72
12a		74	81	81	88
12b		0	0	12	21
12c		1	1	1	1

Table I is a convenient compilation of data on exhaustion for each of the twenty-five structural formulas exhibited in Figures 1-12. It also contains the molecular weights of the structures exhibited in Figures 1-3.

MOLECULAR WEIGHT——The first variation in dye structure studied was that of molecular weight.

The mono-azo dye structure shown in Figure 1a has a molecular weight of 350. By changing from a benzene to a napthalene ring (Figure 1b, mol wt 400), one increases dye exhaustion in both the salt and acid dyebaths.

The addition of two methyl groups to a dis-azo dye (Figures 2a and 2b) causes a similar increase in dye affinity for the acrylonitrile, except that no increase occurs in the salt dyebath.

Figures 3a and 3b show a molecular weight increase made between a mono-azo and a dis-azo dye, but to a higher degree than in the two previous cases. The results show a higher exhaustion in acid and no change in the salt dyebath. A second possibility must be considered in this case. It is possible that the simple addition of an azo group is more influential than the increase in molecular weight.

SULFONIC ACID GROUPS——The second variable in structure considered was the effect of sulfonic acid groups, the presence of which will greatly in-

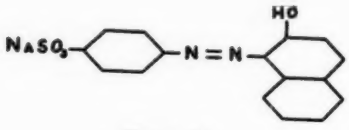


Figure 1a

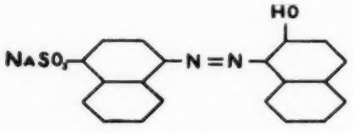


Figure 1b

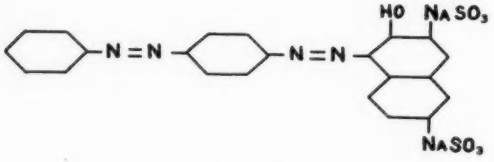


Figure 2a

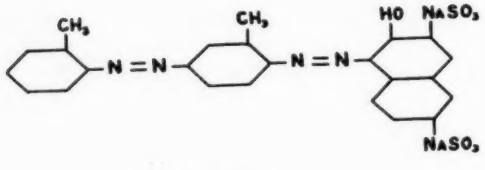


Figure 2b

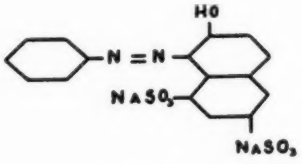


Figure 3a

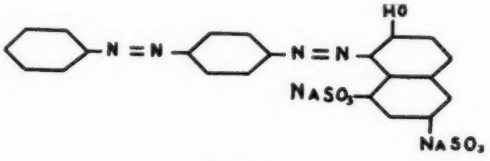
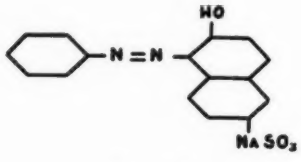


Figure 3b



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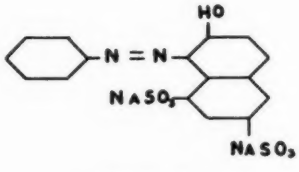

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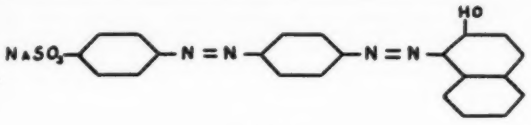

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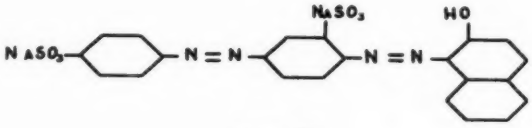
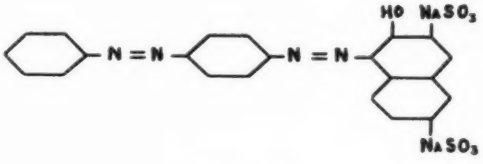


Figure 5b



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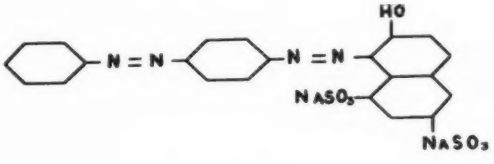

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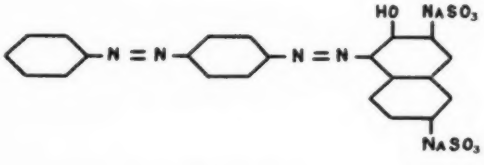

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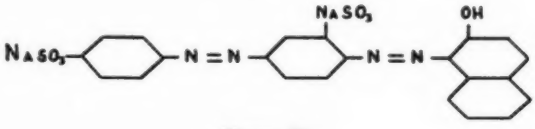

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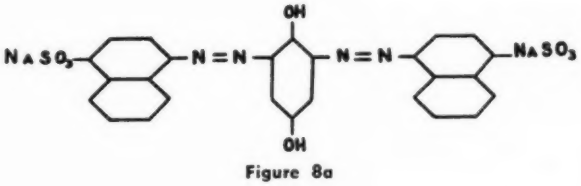
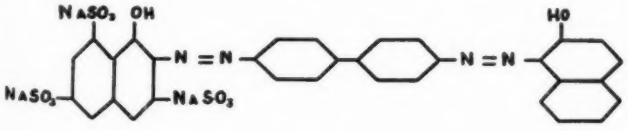


Figure 8a



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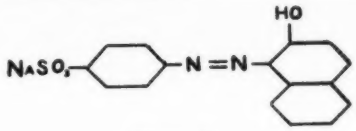
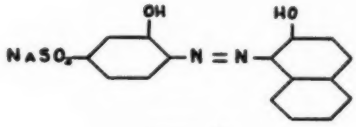


Figure 9a



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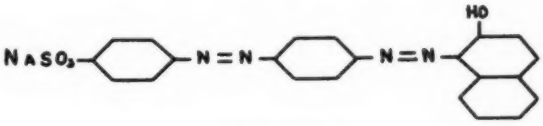

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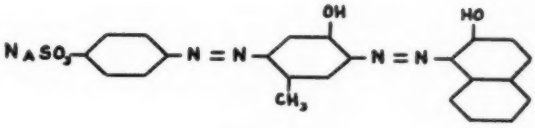

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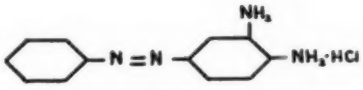

Figure 11a

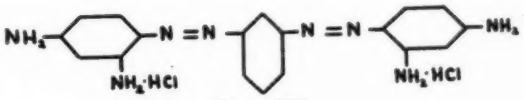

Figure 11b

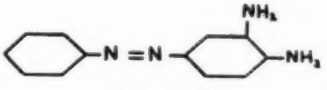

Figure 12a

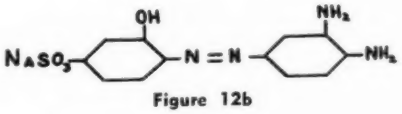

Figure 12b

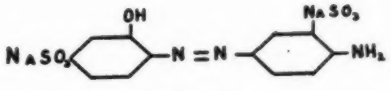

Figure 12c

fluence the ultimate affinity of a dye for acrylonitrile. This can readily be seen from the results obtained with the dye structures shown in Figures 4-8.

Figure 4. The presence of one sulfonic acid group (4a) allows a slight degree of dyeing to take place. The addition of a second sulfonic group (4b) decreases the dye affinity to practically zero.

Figure 5. The dye shown in 5a, a dis-azo dye, exhausts to a very high degree, but again the addition of a sulfonic acid group (5b) decreases the exhaustion to zero. However, in this second case, the decrease in dye affinity is much greater than that of the preceding two mono-azo dyes. Some connection must therefore exist between the negative charge developed by the sulfonic acid groups when the dye is dissolved in aqueous solution and the negative potential believed to exist in the modified acrylonitrile polymer.

Also of prime importance is the position of the sulfonic acid groups when they are present in a dye.

Figures 6-7. The effect obtained by changing one sulfonic acid group from a beta position to an alpha position is negligible (Figures 6a and 6b).

However if the sulfonic acid groups are placed in widely separate positions, as indicated by the combination of dye structures in Figure 7, an appreciable decrease in dye affinity occurs.

Figure 8. Although the two dye structures in Figure 8 are not completely comparable, they do illustrate the importance of position. Two sulfonic acid groups are present in the first at widely separated places, and again no affinity is found to exist between the dye and the modified acrylonitrile. The second structure has three sulfonic acid groups but all are located at one end of the extended molecule. This dye, even though it has three acid groups, has an affinity in acid solution equivalent to one or two of the few basic dyes recently used on the Orlon.

HYDROXYL GROUPS——Unlike the sulfonic acid groups, hydroxyl groups present in dye structure do not give a clear-cut indication of their effect.

In the case of the two mono-azo dye structures in Figure 9, an increase in the number of hydroxyl groups adds some affinity to a molecule which previously had none.

In contradiction to this we find that between these two dis-azo dye structures the addition of a hydroxyl group, in the same relative position (Figure 10) decreases the dye affinity considerably. It was previously found that the addition of a methyl group increases dye affinity, therefore it is concluded that the hydroxyl group in this case must play an important part in determining the affinity.

AMINE GROUPS——In spite of the fact that several of the aforementioned dyes showed high affinity, none seem to give more consistant results than those with amines present in their structure.

For example, Figure 11 shows two dyes which contain two and four amines respectively in their structure. In both cases a high degree of exhaustion occurs in the salt and acid dyebaths.

Figure 12 shows the final set of dyes studied to determine the effect of sulfonic acid groups in the presence of amines. The addition of an acid group decreases to a marked degree the affinity of the dye. There still remains affinity in the acid dyebath but none in the salt bath. When the number of acid groups is greater than the number of amines present no dye is absorbed by the acrylonitrile polymer in either the acid or salt dyebath.

SUMMARY

The results obtained with the mono-azo and dis-azo dyes show that:

1) In general, increases in molecular weight increase the dye affinity in acid dyebath but not in salt. The manner in which the increase is made is also important.

2) In general, the presence of sulfonic acid groups in the mono-azo dyes prevents dye absorption. For dis-azo dyes, as the number of sulfonic acid groups increases from one, the salt dyebath exhaustion decreases to zero, and the acid dyebath decreases to a variable degree depending on the dye.

3) Although sulfonic acid groups are present in a dye molecule, it is possible to have considerable affinity if they are properly positioned in the molecule.

4) Hydroxyl groups give no clear-cut indication of their behavior in dyeing acrylonitrile.

5) Amines present in a dye molecule either alone or in excess of sulfonic acid groups will facilitate the dyeing of Orlon 42.

REFERENCE

(1) Northern New England Section, AATCC, "Relationship between Structure of Dyes and their Dyeing Characteristics on Hydrophobic Fibers", *Am Dyestuff Reptr* 43, P426 (1954).

AATCC

Monograph No. 2

"THE APPLICATION OF VAT DYES"

"The group of fifteen editors responsible for this monograph consists of a well-balanced cross-section of American industry concerned with the production, marketing and application of vat dyes. The AATCC is to be congratulated on the production of a comprehensive survey of American vat dyeings and printing practice which is the major theme of this application . . . the book will be useful as a work of reference at this side of the Atlantic and as a working manual for the American colorists for whom it was designed. . . . If a clear account of American practice is required . . . the enquirer *must* have access to this volume."—*JOURNAL OF THE TEXTILE INSTITUTE* (England).

"This monograph contains the work of many mill-experienced authors, plus good, sound chemical and application principles developed in the laboratories and mills enjoying AATCC membership. . . . This book puts between two covers much information that a dyer is constantly searching for. It is a good investment for any laboratory, dyehouse, or printshop."—*TEXTILE WORLD.*

". . . this monograph should be in the hands of every user of vat dyestuffs, every student and every teacher. The book is well indexed and includes valuable lists of equivalent trade names. It will certainly take its place as a standard book of reference."—*"JOURNAL OF THE SOCIETY OF DYERS AND COLORISTS* (England).

"This book is . . . abreast of the latest technical developments and research. Its value is increased because of the lack of books in this field today . . . we can readily recommend this book to all technical and practical men"—*MELLIAND TEXTILBERICHTE* (Germany).

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SEND CHECK OR MONEY ORDER TO

DR H C CHAPIN,
SECRETARY
AMERICAN ASSOCIATION OF TEXTILE CHEMISTS AND COLORISTS
P O BOX 28, LOWELL, MASSACHUSETTS

Minutes ——

TWO-HUNDREDTH COUNCIL MEETING

H C CHAPIN, Secretary

THE Council held its 200th meeting in the Hotel Statler, New York, N Y, on Friday morning, January 20, 1956. Present were President Raymond W Jacoby presiding; Joseph H Jones, Ernest R Kaswell, Walter M Scott and Frederick V Traut, vice presidents; Leonard S Little, chairman of the Executive Committee on Research; William D Appel, J Robert Bonnar, Carl Z Draves, Henry F Herrmann, Thomas R Smith and P J Wood, past presidents; Roland E Derby, Jr, representing Northern New England; Francis H Casey, Ernest J Chornyei, Edward H Gamble and Raymond B Taylorson representing Rhode Island; Rudolph C Geering and Raymond J Carey representing Western New England; Bernard K Easton representing Niagara Frontier; Irwin J Smith representing Hudson-Mohawk; Robert C Allison, Matthew J Babey, William F Brommelsiek, Percy J Fynn, Herman E Hager, Patrick J Kennedy and Harry Moore representing New York; Arthur W Etchells, Thomas H Hart, Clarence A Seibert, Richard A Shimp and Jackson A Woodruff representing Philadelphia; Lawrence L Heffner representing Washington; Wyss L Barker, A Henry Gaede, Harley Y Jennings, Henry A Rutherford and R Hobart Souther representing Piedmont; Joseph D Mosheim representing South Central; John C Cook representing Southeast; Eric W Camp representing Mid-West; Hubert A DesMarais representing Pacific Northwest; Charles W Dorn and Charles A Sylvester of the Technical Committee on Research; James A Doyle of the Publicity Committee, Clarence Hooper, chairman of the Piedmont Section; George O Linberg of the Committee on Conventions; William A Holst of the Committee on Constitution and Bylaws; Albert E Johnson of the Corporate Membership Committee, L H Hance, president of the National Council for Textile Education; Ernst W Empting, Thomas R Scanlan, Jr, William M Segall; and Harold C Chapin and Richard R Frey of the secretary's office.

Raymond W Jacoby was reported elected president; and Joseph H Jones, Ernest R Kaswell, Walter M Scott and Frederick V Traut, vice presidents.

The secretary's report of the 199th Council meeting and financial report of December 16th, and the treasurer's report of January 4th, were accepted. In consideration of the sudden illness of the treasurer, and possibility that this might incapacitate him for some time, Leonard S Manchester was appointed assistant treasurer. The president and secretary jointly were voted power to instruct the First National Bank of Boston that it may pay checks drawn against the treasurer's account and signed by Mr Manchester; also like power with reference to the treasurer's account in the Middlesex County National Bank.

The vice presidents reported on their respective Regions; Mr Traut referring to a course on "The Application of Vat Dyes" just started under auspices of the Philadelphia Section; Mr Kaswell, on a February 17th meeting at the Quartermaster Laboratories in Natick to present results of last summer's atomic bomb tests to Civil Defense authorities as guests of the Northern New England Section, and on the convention of 1957 in Boston; Mr Jones, on plans for the convention of 1958 in Chicago.

Mr Little reviewed activities of the Executive Committee on Research under his chairmanship, and was voted thanks for his services. His proposal that William D Appel be appointed delegate of the Association to ISO meetings in England in May was referred to the new Committee on Inter-Society Relations. ISO meetings in New York on Thursday, Friday and Saturday preceding Perkin Centennial week would be devoted to color fastness and shrinkage in laundering.

Committees were appointed, or stand, as follows:

E C R

C W Dorn, *chairman*
C A Sylvester, *vice chairman*
R C Allison, *secretary*
H W Stiegler, *director of research*
J R Bonnar, S Converse, W A Holst, R W Jacoby, E W Lawrence, E A Leonard, P B Stam, A R Wachter.

APPROPRIATIONS

A E Sampson, *chairman*
H C Chapin, C Z Draves, P J Wood, T R Smith.

PUBLICATIONS

W M Scott, *chairman*
N A Johnson, *secretary*
J R Bonnar, W H Cady, H C Chapin, J A Doyle, C Z Draves, W A Holst, R W Jacoby, H Y Jennings, J H Jones, E R Kaswell, E W Lawrence, P J Luck, P Theel, F V Traut, C A Whitehead.

MEMBERSHIP AND LOCAL SECTIONS

J H Jones, *chairman*

H C Chapin, E R Kaswell, W M Scott, F V Traut.

CONSTITUTION AND BYLAWS

H C Chapin, *chairman*
W A Holst, P Theel.

SECRETARY'S FINANCIAL REPORT — DECEMBER 16, 1955

	Applications	*Dues, regular & reinstate*	*Dues, Corporate & Sustaining*	*Miscellaneous*	*Totals*
Received & transmitted to Treasurer, August 1 to October 25, 1955	1345.00	22355.00	3250.00	3247.46	30197.46
October 25 to December 16, 1955	933.00	25921.50	10055.00	4217.83*	41127.33
Total rec'd & transmitted to Dec 16	2278.00	48276.50	13305.00	7465.29	71324.79
Leaving deposited with Secretary by Treasurer					9018.67
For comparison, receipts to 12/16/54	2424.50	46058.00	20832.50	9619.86	78934.86

* Miscellaneous items:

Reporters and reprints	29.05
Year books	1549.66
Crockmeters	387.62
Water test apparatus	74.70
Dyed standards	20.00
Knitted tubing	8.00
Buttons	9.75
Color transfer charts	105.00
Flammability apparatus	101.00
Application of Vat Dyes	199.60
Standard grease wool	66.00
Accelerotor liners	186.25
Grey scales	19.50
Reimbursement for 1955 Convention exp	1461.70
	4217.83

H C CHAPIN
Secretary

TECHNICAL SUPPLIES

H C Chapin, *chairman*
C W Dorn, R W Jacoby, A E Sampson, H W Stiegler.

CORPORATE MEMBERSHIP

A E Johnson, *chairman*
W B Amos, J Anderson, E A Chevrette, A A Curt, J L Eich, R R Frey, J G Kern, E A Leonard, R J Nehmens, W M Segall, R A Shimp, C O Stevenson, R B Taylorson, J M Washburn, Jr.

BIBLIOGRAPHY

W H Cady, *chairman*
A G Bruinier, Jr, M S Furry, R D Greene, R W Joerger, V I McLendon, A R Macormac, G J Mandikos, E L Phelps, J W Place, Jr, R W Sumner, G R Thompson, G F Walz, R K Worner, A S Wrigley.

COLOUR INDEX EDITING

W H Cady, *chairman*
W A Holst, *secretary*
W D Appel, J R Bonnar, J P Matteis, R W Jacoby, C A Sylvester.

COLOUR INDEX MARKETING

A E Sampson, *chairman*
H C Chapin, *secretary*
W H Cady, C W Dorn, J A Doyle, G D Jackson, Jr, R W Jacoby, P Theel.

CONVENTIONS

G O Linberg, *chairman*
R R Frey, *secretary*
One Year—E W Camp, R W Jacoby.
Two Years—F V Traut, C R Gill.
Three Years—A I Hultberg, E R Kaswell.
Four Years—G S Buck, Jr, D E Marnon.

TECHNICAL PROGRAM

W M Scott, *chairman*
Balance to be appointed later.

PRESIDENT'S ADVISORY COMMITTEE

J R Bonnar, *chairman*
C A Whitehead, *secretary*
H C Chapin, H F Herrmann, N A Johnson, J H Jones, E R Kaswell, G O Linberg, A E Sampson, W M Scott, T R Smith, F V Traut, J A Woodruff.

INTERSECTIONAL CONTEST

E D McLeod, *chairman*
J M Gould, K S Howry, T R Smith, J A Woodruff.

PERKIN CENTENNIAL

R W Jacoby, *chairman*
E A Leonard, *vice chairman*
H F Herrmann, *treasurer*
R R Frey, *secretary*
W D Appel, K H Barnard, J R Bonnar, A G Bruinier, Jr, M A Dahlen, H E Hager, R J Hamilton, S L Hayes, P J Kennedy, G O Linberg, D E Marnon, G Meynell, W G Parks, A E Sampson, W M Scott, C A Whitehead, H L Young.

QM — AIR FORCE DYE SURVEY COMMITTEE

W A Holst, *chairman*
W D Baird, O C Bartenbach, W F Brommelsiek, C Byron, J N Dalton, R E Derby, Sr, M G Dimon, L Fusser, A W Grover, C W Lever, M G Stern, R A Link, Jr, L S Little, E A Lutz, H E Millson, A Morrison, J H O'Donnell, A C Merrill, Jr, R D Robinson, C H A Schmitt, H C Spatz, H W Stiegler, W von Bergen.

TECHNICAL COMMITTEE ON RESEARCH

C A Sylvester, *chairman*
M J Babey, *vice-chairman*
J A Woodruff, *secretary*
Balance of Committee to be appointed by the chairman.

INTER-SOCIETY RELATIONS

C Z Draves, *chairman*
H C Chapin, *secretary*
W D Appel, J R Bonnar, C W Dorn, H W Stiegler, C A Sylvester.

SUBJECT AND SPEAKER'S BUREAU

M J Babey, *chairman*
J A Doyle, E A Leonard, C A Whitehead.
The program Chairman of each Section is an ex officio member of this Committee.

PUBLICITY COMMITTEE

J A Doyle, *chairman*
W H Bass, Jr, M H Behrendt, J C Cook, R R Frey, R K Gagnon, K L Howry, F H Ihlenburg, A E Johnson, J G Kelley, W H Leyking, D S Lyle, N W C Pratt, T R Scanlan, Jr, A R Thompson.

ARCHIVES COMMITTEE

Sidney Edelstein, *chairman*

For the President's Advisory Committee Mr Henry Herrmann presented a report on plans for "an executive or administrative secretary-treasurer." The president was authorized to appoint a committee to study this matter and present a report to the Council. Councilors were requested to send inquiries and suggestions to the committee.

On motion of Mr Herrmann it was voted that a statement of error, in the listing of L O Benoliel instead of D J Benoliel under "In Memoriam" in the 1955 Year Book, be mailed to all recipients of the book.

On further motion of Mr Herrmann for the Advisory Committee it was voted that a Committee on Archives be appointed by the president.

Mr Johnson reported for the Committee on Corporate Memberships, particularly on membership renewals according to the new schedule of dues initiated in December.

The invitation for a June Council meeting in Canada was again considered and declined with thanks.

Approved by the Committee on Appropriations, $200 was added to the year's budget of $300 for general publicity, and $5000, in addition to prior loans of $3000, was voted as a loan from the Convention Fund to the Perkin Centennial Fund.

Proposed by the Corporate Membership Committee, and approved by the Committee on Constitution and Bylaws, the following was passed to letter ballot of the Council as a substitute for the statement in Article II, Section 1 regarding Corporate dues, and was subsequently adopted.

> Corporate Member — Optional in accordance with prevailing schedule of suggested dues based upon volume of business and relative interests in AATCC Research.

It was proposed by the Secretary that the first sentence of Bylaw Article IV, Section 9, be changed to

> The Committee on Constitution and Bylaws shall consist of three members appointed by the Council.

This was referred to the Committee on Constitution and Bylaws.

Mr Babey reported that his Subject and Speakers Bureau had obtained four speakers for three different Sections. He requested suggestions of other speakers and subjects.

Mr Doyle summarized activities of his Publicity Committee in the year 1955. He named its members, too widely distributed to meet, so conducting business by mail. A press clipping service showed progress in the placing of news in trade and professional journals and daily newspapers. Local sections had been active in this work. The Committee had cooperated with the Philadelphia Section on convention publicity. It was working on the Perkin Centennial for which mailing machine slugs would soon be available through the secretary's office. A handbook on publicity methods was planned for use by local sections. Mr Doyle reported for the Publications Committee also.

Appointed to draft a resolution against commercialism in papers, Mr Kaswell had

presented the following for approval by the Publications Committee.

"The Association strives to maintain a high scientific and professional standard for papers delivered at meetings and subsequently published. Speakers and authors must make every effort to avoid the use of trade names, commercial products or process names wherever such use may be construed as advertising. Wherever possible scientific nomenclature must be employed. It is recognized that in some instances trade names are necessary to avoid awkward or lengthy description. Certain trade names have been so widely used as to become generic and these normally are permissible. Further, some technical papers may involve the presentation of a new product or process wherein trade name reference is obligatory.

Giving due consideration to such valid exceptions, it is incumbent upon the author to maintain the proper scientific attitude, avoiding any expressions or devices aimed at promoting a particular product or process.

Introduced by Professor Rutherford, L H Hance, president of the Institute of Textile Technology, addressed the meeting on behalf of the National Council for Textile Education, of which he is now president. He stated that last June the textile industry received but 500 textile school graduates to fill 2000 positions. He asked for assistance in presenting the attractions of the industry to chemists and engineers with special textile training. In reply Mr Jacoby mentioned plans for a brochure entitled "Careers in Textiles through Chemistry," and the Educational Committee in connection with the Perkin Centennial. Professor Rutherford offered the following resolution —

Whereas, the future progress and development of the textile industry depends on trained personnel, and

Whereas, the textile and allied industries are presenting more opportunities for textile graduates than can be filled,

Be it resolved, that the AATCC will undertake to promote interest in textile education by all possible means, in cooperation with college level textile schools, through the National Council for Textile Education and any other agencies that would seem appropriate.

This was referred to a committee to be appointed by the President.

For the Committee on Conventions Mr Linberg reported that the convention of 1960 would be in one of the Middle Atlantic States, in location yet to be decided. A letter of invitation from Buffalo was referred to the Committee. The convention of 1957 would be in Boston, 1958 in Chicago and 1959 in Washington. Mr Traut reported the books closed for the convention of 1955, and was again thanked as representative of his committee. Mr Linberg presented a revised program of the Perkin Centennial, and distributed booklets concerning it. All desiring special accommodations for meetings or group meals were asked to notify Mr Linberg at once.

Thomas H Hart, Chairman of the Philadelphia Section, outlined the program of a meeting of the Section to follow the Council meeting of April 20, to which all attending the Council meeting will be invited. The meeting of June 15 will be in the Hotel Statler, New York.

Dr Jennings requested nominations for the Olney Medal Award of 1956, to be presented before March first as outlined on page 2 of the January 2nd issue of *American Dyestuff Reporter*.

The secretary submitted his resignation, effective at the end of the fiscal year on August 1, 1956. This was accepted with expressions of appreciation for services rendered.

Presented by Mr Jones for the Committee on Membership and Local Sections, the following were elected to the classifications specified:

CORPORATE

Archer-Daniels-Midland Co
Firth Carpet Co
James Hunter Machine Co
Mid-West Processors, Inc
Princeton Knitting Mills, Inc
Pyramid Mfg Co, Inc
Pad-Dye Corp
Soluol Chemical Co, Inc
Southern Latex Corp of N C
J P Stevens & Co, Inc (Delta Finish Div)
Textile Age
Ware Knitters, Inc
Warwick Mills
William E Wright & Sons Co

SENIOR

O T Adrian, C A Armstrong, A Arnaud, K Ayan, J F Barr, E W Bateman, H R Bellinson, T W Berry, Jr, O Bota, A C Bowles, C W F Brooks, L J Byrd, V J Christopher, H G Clapp, H A Clark, Jr, P de Saint Phalle, R J Dinan, A A Drake, B R Duncan, J D Egan, Jr, E K Ewing, D Fogel, W Fong, J W Fulbright, K P Fuller, J S Glinski, G W Graham, C L Gray, Jr, S J Guertin, S L Hayes, Jr, G T Hamilton, R L Houston, S E Hunsuck, Jr, T B Hunt, J A Isselin, E S Johnson, G E Jones, C W Kennedy, C C Lane, H Z Lecher, J Y Lee, R C Leedy, T H Li, L Lipkin, M Mann, C F Marks, G C Marti, J C McEvoy, T J McGinn, L J McNamara, W F Mitchell, J S B Morrison, J J Moulson, W F Murphy, F Nasise, W C Nichols, I Norman, Z Ozgur, J J Padbury, H Palfreeman, W N Parsons, R H Pete, G S Pickett, H M Pinner, Jr, W W Ransom, J D Reid, W J Reines, E J Rock, N S Rosner, M S Schiff, G A Schwen, E S Shanley, G R Shookster, F Sievenpiper, E O Smith, Jr, R Smith, M M Solomon, N C Sprinkle, R B Stump, L S Sun, E A Taylor, H J ten Cate, L L Touton, A R Tremaine, E J Unsworth, L M Vickery, P K Villinger, J J Wall, E Wegman, C J Wessel, H L H Wong, Y N Yang.

JUNIOR

G L Brothers, S E Cesan, A Lamont, G J Moore, B K Owens, E Papa, N H Russo, A E Kebb, F Wolski.

ASSOCIATE

J E Campbell, G C Chemas, D C Chiarello, E M Cook, P C Douglass, R D Elder, W H Funderburke, J Goodman, A Guisard, T P Hatchett, J F Hudgins, J G Kennedy, R W King, J R Lilley, N W Lynn, V J Moser, R H Pearson, Jr, A M Richter, C W Seitz, B Silverman, R E Singer, J M Stearns, E Stock, J Vernon, R E Vicklund, R Vining, P J M Voorwald, J D Wingrave, I T Yu.

STUDENT

B T Adams, M Alam, W E Alford, R Ali, I E Ballenger, E J Bannister, L I Belkin, W B Bennett, D S Bernzweig, R L Bridgman, N R Brookins, A Brumlik, W M Campbell, W Choupres, J B Colquitt, D S Condrey, G J Doucet, L Frates, J K Friedrich, P N Gauvin, J F Greene, Jr, P M Grosbein, B A Gulbranson, C L Hall, Jr, R Halshaw, Jr, B L Harrell, J W Harrison, R L Hawes, C E Hodgkins, K G Jordan, M Kaplan, J P Kondig, L E Liddle, F W Marco, J R P Marco, R J Marois, Jr, R N Martin, R H Medeiros, M F Meier, M Mendoza, J L Mercer, G D Moss, R O Moyer, Jr, C K Nelson, R J Nestor, J V Nicodemus, Jr, H C Ouellette, R L Pellissiar, W J Perron, P A Perry, A M Pfister, R Ploure, W L Polhemus, L Port, R S Powell, J E Price, K J Provost, F Raudelunas, S Sakaguchi, J E Salmon, R Serpa, W H Sherman, H I Shulock, M L Silva, A Silveira, Jr, R E Steeg, A C Teixeira, D U Tilley, Jr, J Q Wright.

TRANSFERRED FROM OTHER CLASSIFICATIONS TO SENIOR

W E Belanger, R V Carlson, Jr, R J Cicione, J D Compton, R C Demuth, G A Jeandros, F J Lachut, M Mackenzie, Jr, L S Manchester, W L Mathias, G L Morgan, C Na, G J Pelliccione, A R Sahasranam, J H Schell, K E Schmalenberger, L A Shive, W F Taylor, R J Tucci, D T Tweedy, P A Woerner.

Respectfully submitted,
H C CHAPIN
Secretary

AATCC CALENDAR

COUNCIL

Apr 20 (Benjamin Franklin Hotel, Philadelphia, Pa); June 15; week of Sept 10th (New York, N Y); Nov 16; Jan 18, 1957.

NATIONAL CONVENTIONS

Sept 13-15, 1956 (Waldorf-Astoria, New York) (as part of the Perkin Centennial, Sept 10-15); 1957 (Boston); 1958 (Hotel Conrad Hilton, Chicago); 1959 (Washington, DC)

HUDSON-MOHAWK SECTION

May 18 (Ladies' Nite); June 22 (Annual Outing).

MID-WEST SECTION

May 5 (Plankington Hotel, Milwaukee, Wis); June 16 (Outing—Browns Lake Resort, Burlington, Wis)

NEW YORK SECTION

Apr 27, May 18 (Kohler's Swiss Chalet, Rochelle Park, N J).

NIAGARA FRONTIER SECTION

Apr 27 (U S).

NORTHERN NEW ENGLAND SECTION

Apr 27 (Lowell Technological Institute, Lowell, Mass); Sept 28 (Annual Outing—Wachusett Country Club, West Boylston, Mass); Oct 19 (Science Park, Boston, Mass); Dec 1 (Annual Meeting—Hotel Vendome, Boston)

PHILADELPHIA SECTION

Apr 20 (Ladies' Night — Benjamin Franklin Hotel, Philadelphia); May 25 (Annual Outing — Huntingdon Valley Country Club, Abingdon, Pa); Sept 28 (Abraham Lincoln Hotel, Reading, Pa); Nov 2 (John Bartram Hotel, Philadelphia, Pa); Dec 7 (Kugler's Restaurant, Philadelphia, Pa)

PIEDMONT SECTION

June 8-9 (Outing — Mayview Manor, Blowing Rock, N C); Oct 6 (Annual Meeting—Hotel Charlotte, Charlotte, N C)

RHODE ISLAND SECTION

Apr 26 (Student Night, Rhode Island School of Design); May 25 (Ladies' Night, Sheraton-Biltmore Hotel); June 15 (Annual Outing, Pawtucket Country Club); Oct 18 (Johnson's Hummocks Grille); Dec 6 (Annual Meeting, Johnson's Hummocks Grille)

SOUTH CENTRAL SECTION

Apr 28 (Hotel Patten, Chattanooga, Tenn); June 22-23 (Lookout Mountain Hotel); Dec 1 (Hotel Patten)

SOUTHEASTERN SECTION

Apr 14 (Lindale, Ga); June 8-9 (Outing—Radium Springs, Albany, Ga); Sept 22 (Columbus, Ga); Dec 8 (Atlanta, Ga).

WESTERN NEW ENGLAND SECTION

May 4 (Ladies' Night—Waverly Inn, Cheshire, Conn); June 15 (Outing); Oct 15 (Annual Meeting—Hartford, Conn); Nov 16 (Rapp's Restaurant, Shelton, Conn)

EMPLOYMENT REGISTER

This column is open for two insertions per year, per member, without charge. Blanks can be obtained from, and filed with, the Secretary of the Association, Post Office Box 28, Lowell, Mass. It is understood that these will be open to inspection by prospective employers who can obtain further information from the Secretary.

56-3

Education: Part of textile institute course in chemistry & dyeing.

Experience: Chemist & dyer for one worsted manufacturer, thirty years.

Age: 48; married; references; position in dyestuff laboratory near Philadelphia desired.

3-26, 4-9

NOTICE

To Authors and Section Officials

Under a ruling of the Publications Committee, all papers presented before local sections of AATCC must be submitted direct to the publishers of the AMERICAN DYESTUFF REPORTER, 44 East 23rd St, New York 10, N Y. Two copies of each manuscript should be submitted in accordance with the "Notice to Authors", which appears on page 216 of this issue.

ACTIVITIES OF THE LOCAL SECTIONS

NEW YORK

A MEETING of the New York Section was held on Friday evening, March 23rd, at Kohler's Swiss Chalet, Rochelle Park, New Jersey. The chairman, John H Hennessey, introduced visitors from the Piedmont and Western New England Sections. Dr Paul L Meunier, manager, sales development, dyestuff division, E I du Pont de Nemours & Co, Inc, spoke on "Practical Aspects of the Pressure Dyeing of Piece Goods in the Burlington Machine". The attendance was over 200.

RHODE ISLAND

APPROXIMATELY 175 members and guests attended the March 22nd meeting of the Rhode Island Section at the quarters of the Providence Engineering Society, sixty of which enjoyed a pre-meeting social hour and dinner at the Crown Hotel.

Speakers of the evening were Robert H Phillips, assistant director, Research and Development Laboratories, Cranston Print Works Co, and Joseph B Evans, vice president and director of sales, Dexter Chemical Corp. Mr Phillips presented a paper, "Wash and Wear Fabrics," of which he and Edward W Lawrence, director of the Research and Development Laboratories, are authors. Mr Evans spoke on "Sales — An Ideal Career."

George O Linberg, Synthron, Inc, outlined the general program for the Perkin Centennial.

The Section will hold its next meeting (the annual Student Night meeting) at the Rhode Island School of Design on Thursday, April 26.

MEETING OF THE RHODE ISLAND SECTION

MEETING OF THE RHODE ISLAND SECTION

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FEBRUARY 23, 1956

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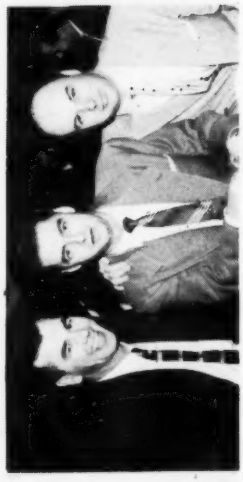
JOHNSON'S HUMMOCKS GRILLE
PROVIDENCE, R I



(Courtesy of John E Trezise)

Perkin Centennial Notes

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AATCC CONVENTION

TECHNICAL PROGRAM COMMITTEE
Walter M Scott
U S Department of Agriculture,
Washington 25, D C.

PROCEEDINGS OF THE PERKIN CENTENNIAL

EDITOR
Howard J White, Jr
Textile Research Inst,
Princeton, N J.

INTERNATIONAL DAY

"International Day", Monday, September 10th, will serve as the kickoff for the week-long Perkin Centennial celebration, which will be held September 10-15 at the Waldorf Astoria Hotel, New York, N Y.

Sponsored by the American Standards Association and the International Organization for Standardization, International Day will feature morning, luncheon and afternoon sessions.

Leonard S Little, chairman, and George P Paine, secretary, head an International Day Committee composed of William D Appel, J Robert Bonnar, Charles W Dorn, Charles E Hilton, Raymond W Jacoby, and Charles A Sylvester.

MORNING SESSION

The morning session, scheduled for 9:30 am in the Empire Room, will be devoted to "Colorfastness of Textiles", under the auspices of AATCC and ASTM.

Charles A Sylvester, E I du Pont de Nemours & Co, Inc, chairman of AATCC's Technical Committee on Research, will serve as chairman; Raymond W Jacoby, Ciba Co, Inc, chairman of the Perkin Centennial Executive Committee and president of AATCC, will welcome the group; and William D Appel, National Bureau of Standards, chairman of ASA Committee L23, USA Advisory Committee for ISO/TC 38—Textiles, chairman of ASTM Committee D-13, and past president, AATCC, will serve as moderator.

Topics will include the following:

"A Century of Progress in Colorfastness Test Methods"—M L Staples, chairman, Subcommittee B-1 on Chemical Test Methods, ASTM D-13 on Textiles; assistant director, Textile Department, Ontario Research Foundation, Toronto, Canada.

"Current Developments in Colorfastness Testing: France, Germany, Switzerland, United Kingdom, and United States of America". Speakers for France, Germany, and Switzerland will be announced. P W Cunliffe, chairman of the Fastness Tests Coordinating Committee, Society of Dyers and Colourists, and research manager, British Cotton and Wool Dyers Association, Ltd, Manchester, England, will speak for the United Kingdom. Mr Sylvester will speak for the USA.

LUNCHEON SESSION

The Luncheon Session is scheduled for 12:15 pm at the Starlight Roof.

H Thomas Hallowell, Jr, Standard Pressed Steel, president of ASA, will preside, and Mr Jacoby will offer greetings.

Guest speaker will be Sir Robert Robinson, official representative of the Society of Dyers and Colourists, who will discuss "Sir William Perkin—His Life and Works".

AFTERNOON SESSION

The afternoon session, also slated for the Starlight Roof, will commence at 2:15 pm. Under the auspices of ASA and ISO, the Session will have as its theme: "Color———The Catalyst of Commerce".

Charles W Dorn, J C Penney Co, chairman of AATCC's Executive Committee on Research and chairman, Technical Committee, National Retail Dry Goods Association, will serve as chairman. J Robert Bonnar, General Dyestuff Co, a past president of AATCC, will serve as moderator.

A question-and-answer panel of domestic leaders from the following fields is planned: advertising, automotive, consumer, converting, dyestuffs and fine chemicals, fabric manufacturing, fiber manufacturing, finishing, garment manufacturing, household appliances, packaging, paper, plastics, retailing, safety, style and fashion, and television. Three overseas guests will round out the panel.

EXHIBITS

Definite progress has been made with plans for three of the proposed exhibits at the Centennial, namely 1) "A More Colorful World", the cooperative exhibit of dyestuff manufacturers, which will be held in the Astor Gallery, 2) Fibers and Fabrics, slated for the Jade Room, and 3) Functional Finishes, Basildon Room. A fourth exhibit, devoted to AATCC research, is being planned for the area under the balcony at the end of the East Ballroom.

HOTEL RESERVATION FORMS

Hotel reservation forms will be sent out to AATCC members this month, giving complete information on the facilities available during the Centennial celebration.

Protein Structure——

(Continued from page 215)

To return to the M, N, O of protein fiber properties, we can note at once a connection with the A-1 desirable property, from the users' point of view, namely, color or dyeability. The ability of the natural protein fibers, silk and wool, to accept dyes has long been the delight of the dyer, and the man-made protein fibers show that property, because of their chemical similarity.

Another relation between our alphabetical groups can be seen, between the *Numerous* reactive groups, and the C for *Comfort* group, in the moisture and static relations. The presence of numerous reactive groups, located both along the main chain as peptide linkages, and in the side chains as well, gives higher moisture sorption capacity, and lower electrical resistivity, over a wider range of relative humidities, than other fibers less supplied with polar groups to act as sites for water sorption. This can be seen in work reported by Hersh and Montgomery *(7)*, Ballou *(1)* and Keggin, Morris and Yuill *(10)*. From this it appears that protein fibers as a group are indeed intermediate in electrical resistance between cellulosic fibers and the low moisture content man-made fibers.

However, we have made only two, dyeability and electrical resistance, of the numerous correlations which are possible between protein structure and desirable fiber or fabric properties. We want to make only one more such correlation, one which suggests itself as perhaps the most important of all. Its importance is at least quantitatively greater than the two which have already been considered, because it ties in with most of the remaining subordinate parts of the ABC properties, in one way or another.

In trying to bring out this correlation, let us look at certain fiber properties, as shown in the stress-strain or load-elongation curves of several fibers (Figure 1).

These curves show a characteristic difference of shape, which corresponds to a recognizable difference of properties. Certain fibers — cotton and nylon, for example—either resist increase in elongation with the same force requirement for unit elongation, or actually work harden with increasing elongation, rather in the same way that annealed metal work hardens.

Other fibers, of which wool and man-made protein fibers are examples, have a stiffness limit, below which they resist change at about the same rate or modulus as the other fibers, but above which they elongate with very little additional force requirement. This is not, however, a yielding to break; there is a final upturn or hardening in these fibers also. However, the long yielding region of the stress-strain curve, the stiffness limit, permits the protein fibers to show a "deep softness" unlike that of any other group of fibers.

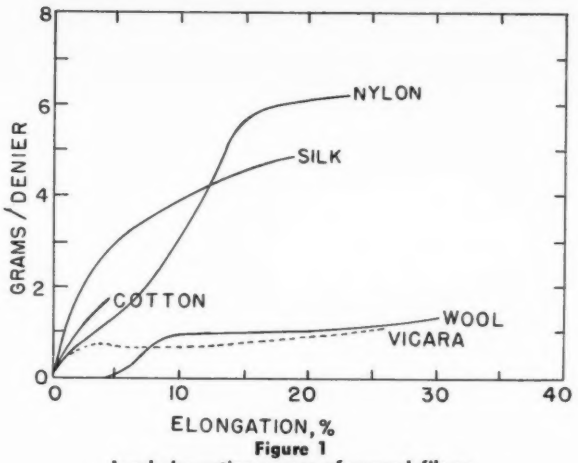

Figure 1
Load-elongation curves of several fibers
Nylon, silk, and cotton from Susich and Backer, 1951 (*13*).
Wool from Susich and Zagieboylo, 1953 (*14*).
Vicara (zein), 1954 production.

Recognition of the importance of differences in the stress-strain characteristics of fibers has been developed in many studies of stress-strain-time relations and interpretations of the mechanical properties of fibers, such as those of H DeWitt Smith *(12)*, Hamburger and associates *(4, 5)* and workers at the Textile Research Institute *(3)*. Change of modulus as a distinctive characteristic of wool has been emphasized and described in relation to desirable fabric properties by Hoffman *(8)*. The term "compliance ratio" has been used by Beste and Hoffman *(2)* to characterize the "additional characteristic possessed by wool — its diminishing modulus." The stiffness of wool decreases rapidly with the load and elongation, and with the duration of the load. . . . As a result, wool has a dual nature. It is fairly stiff and spring-like for short loading times and low strains, but it becomes increasingly compliant at longer loading times and higher strains. This dual nature underlies the fact that a good woolen fabric can be described as being crisp and yet soft."

These considerations led Beste and Hoffman to define compliance ratio as a measure of this diminishing modulus. Bearing in mind that compliance is the reciprocal of modulus the definition is as follows:

TABLE I
VARIATIONS IN COMPLIANCE RATIO

Fiber	*Compliance Ratio (den/g)*
AT 60% RH*	
nylon	—.19
cotton	—.04
silk	.29
viscose rayon	.68
wool	1.04
zein	1.80
casein	2.70
AT 65% RH	
rayon	0.5
wool	1.3
Vicara (zein)	1.5

* Beste and Hoffman *(2)*

Table I illustrates the range of variation in compliance ratio.

It will be obvious to you that the stress strain curve and the compliance ratio as discussed so far are concerned only with the stretching-out part of the use of the fiber, and that the user is also much concerned with the coming-back part of the cycle, especially for crease holding. Some measurements of crease recovery are shown

TABLE II
CREASE RECOVERY (PERCENT)
AATCC Method 66-52
(Monsanto Wrinkle Recovery Test)

Fiber	*Fabrics*	*Relative humidity*	
		65%	85-95%
wool	6	91-86	83-69
Vicara	2	81-78	70-60
rayon	1	54	31

Compliance ratio (measure of diminishing modulus or stiffness limit) =

$$\frac{\text{compliance at 10\% elongation} - \text{compliance at 5\% elongation}}{5} = \frac{\frac{10}{\text{load}_{10}} - \frac{5}{\text{load}_{5}}}{5} = \frac{\frac{1}{M_{10}} - \frac{1}{M_{5}}}{5} = \frac{2}{L_{10}} - \frac{1}{L_{5}}$$

TABLE III

COMPRESSION TESTS ON SOCKS[e]

Fiber	*Thickness*[a]	*Compressibility*[b]	*Recovery*[c]	*Work/Volume*[d]
wool	90	20	13	14
	125	22	14	16
	170	16	9	11
nylon (spun)	44	20	8	13
	52	14	6	10
	118	13	6	10
cotton	44	7	5	5
	45	11	7	9
	117	12	4	8

[a] Thickness in mils, 1000 mils = 1 inch, at 1.0 lb/in^2.
[b] Compressibility = 100 x (change in thickness between 0.5 lb/in^2 and 1.5 lb/in^2)/(thickness at 1.0 lb/in^2), in compression.
[c] Recovery, similar to compressibility with thicknesses in recovery.
[d] Work/volume = (work of compression between 0.1 and 2.0 lb/in^2)/(Thickness at 1.0 lb) in units of 0.025 inch x lb.
[e] Method: Schiefer compressometer (*11*).

in Table II, which indicates the similarity of protein fibers in high crease recovery.

The difference arising from difference in deep softness, stiffness limit, or compliance ratio, is probably best appreciated by feeling — by actual touch and pressure. In such examination, the effect of fiber diameter, crimp, twist, nap, and finish are also all involved. However, one can find quantitative evidence for the deep softness of protein fibers in measurements made by compressing the fibers in the form of knit goods, such as socks, in the range between 0.1 and 2.0 pounds per square inch pressure (Table III). The compressibility, the recovery, and the work absorbed per unit volume of fabric all tend to range higher for wool.

A string of theory is needed, to tie up the facts, which we have just been considering, into a neat bundle. We don't have the time, nor indeed all the facts which we need to elaborate this theory, but let it be presented simply as a means to tie together the relations between protein structure and the specially desirable deep softness or high compliance ratio of protein fibers. The idea commends itself, that the special yielding characteristics, and the relatively long-range resilient characteristics of the protein fibers arise from two conditions: the noncrystalline or amorphous character of the molecular organization, and the reinforcement of this mass by cross linkages at separated points. The model is very clear in the case of wool and the other natural keratine *(6)*; there is reason to believe that it applies over the whole range.

CONCLUSION

We can conclude by pointing out that the XYZ and all the intermediate letters are yet to be used in such a listing as this. We should remember that a beautiful textile, pleasing to eye and hand, is a work of art in itself, which will always remain a challenge to man's sensibility or capacity for aesthetic appreciation, as well as to his ingenuity or his powers of analysis.

ACKNOWLEDGMENT

We are grateful for permission to present data from reports on Vicara fiber and fabrics, made for the Virginia-Carolina Chemical Corp.

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(12) Smith, H D, *Proc ASTM* 44, 543-592 (1944).
(13) Susich, G, and Backer, S, *Textile Research J* 21, 482-509 (1951).
(14) Susich, G, and Zagieboylo, W, *ibid* 23, 405-417 (1953).

GENERAL CALENDAR

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

Gordon Research Conferences—Textiles Program, July 9-13, Colby Junior College, New London, N H.

AMERICAN ASSOCIATION FOR TEXTILE TECHNOLOGY, INC

May 2, June 6, Sept 5, Oct 3, Nov 7, Dec 5 (All meetings at the Vanderbilt Hotel, New York, N Y).

AMERICAN SOCIETY FOR TESTING MATERIALS

June 17-22—59th Annual Meeting and 12th Apparatus Exhibit, Chalfonte-Haddon Hall, Atlantic City, N J; Sept 16-22—2nd Pacific Area National Meeting and Apparatus Exhibit, Hotel Statler, Los Angeles, Calif; Oct 16-19—Fall Meeting of Committee D-13 on Textiles, Warwick Hotel, New York, N Y.

ASSOCIATION OF BRITISH CHEMICAL MANUFACTURERS

Chemical Display (as part of British Industries Fair)—April 23-May 4, Olympia Hall, London, England.

DELTA KAPPA PHI FRATERNITY

32nd National Convention—April 27-28, Georgia Institute of Technology, Atlanta, Ga.

THE DRYSALTERS CLUB OF NEW ENGLAND

May 4 (Hotel Vendome, Boston, Mass); June 22 (Outing, Wachusett Country Club, West Boylston, Mass)

THE FIBER SOCIETY

Spring Meeting—May 2-3, The Clemson House, Clemson, S C; Fall Meeting—Sept 6-7, Warwick Hotel, New York, N Y.

THE INSTRUMENT SOCIETY OF AMERICA

11th Annual Instrumentation-Automation Conference and Exhibit—Sept 17-21, New York Coliseum, New York, N Y

LOWELL TECHNOLOGICAL INSTITUTE

May 10 (Textile Education and Machinery Day, American Textile Machinery Association annual meeting); May 19 (Alumni Day); June 17—Baccalaureate and Commencement Activities); Sept 26-28 (Perkin Centennial observance and open house). All events on campus at Lowell, Mass.

PERKIN CENTENARY

May, 1956—London, England.

PERKIN CENTENNIAL

September 10-15, Waldorf-Astoria Hotel, New York, N Y.

PHI PSI FRATERNITY

Annual Meeting—April 19-21, Alabama Polytechnic Institute, Auburn, Ala.

PHILADELPHIA TEXTILE INSTITUTE

June 14 (Annual Meeting and Clambake—6 pm—College Campus, Germantown, Pa); June 15 (Outing—Manufacturers Golf & Country Club, Oreland, Pa); June 16 (Commencement—College Campus—11 am).

THE QUARTERMASTER ASSOCIATION

Annual Convention—Oct 27-28, Conrad Hilton Hotel, Chicago, Ill.

QUEBEC SECTION, CANADIAN ASSOCIATION OF TEXTILE COLORISTS AND CHEMISTS

Apr 20-21 (Annual Meeting, Sheraton Mt Royal Hotel, Montreal); June 16 (Annual golf tournament).

SOUTHERN TEXTILE EXPOSITION

19th Exposition, Oct 1-5, Textile Hall, Greenville, S C.

SYNTHETIC ORGANIC CHEMICAL MANUFACTURERS ASSOCIATION OF THE UNITED STATES

Apr 12 (Palm Terrace Suite, Hotel Roosevelt, New York, N Y); May 16-18 (Outing—Skytop, Pennsylvania); June 12, Sept 11, Oct 9, Nov 7 (Palm Terrace Suite, Hotel Roosevelt, New York, N Y)

TEXTILE TECHNICAL FEDERATION OF CANADA

5th Bi-annual Textile Seminar—June 5-7, Queen's Univ, Kingston, Ont.

News of the Trade

• British to Celebrate Perkin Centenary Next Month

The following program of events has been arranged for Britain's celebration of The Perkin Centenary next month:

Monday, May 7th (evening): *Reception*——Representatives of the sponsoring bodies will receive overseas delegates to the celebration at the Hall of the Worshipful Company of Tallow Chandlers, London.

Four lectures will follow, to be held at the Royal Institution, Albemarle St, London, W1, as detailed below:

Tuesday, May 8th: *1st Lecture*——"The Life and Work of Perkin," by Prof John Read, Univ of St Andrews. Chairman: Sir Robert Robinson, chairman, Perkin Centenary Celebration Committee.

Wednesday, May 9th: *2nd Lecture*—— "The Development of the Dyestuffs Industry," by Clifford Paine, Imperial Chemical Industries Ltd. Chairman: the president of the Society of Chemical Industry.

3rd Lecture——"The Tinctorial Arts Today," by J G Evans, Bradford Dyers' Association. Chairman: the president of the Society of Dyers and Colourists.

Thursday, May 10th: *4th Lecture*—— "The Development of Organic Chemistry since Perkin's Discovery," by Prof Alexander R Todd, Univ of Cambridge. Chairman: the president of the Chemical Society.

An additional reception is planned for Tuesday evening, May 8th, for delegates and guests at Guidehall, London.

The Perkin Centenary Banquet will be held Wednesday evening, May 9th, at the Dorchester Hotel, Park Lane, London, W1. Prof Cyril N Hinshelwood, president of the Royal Society and president of the Perkin Centenary Celebration, will be in the Chair.

• Loebl Offers Services to Nylon Net Manufacturers

Loebl Dyers, Inc, Atlanta, Ga, following the completion of its research on the dyeing of nylon net laundry bags, has announced that it is in a position to offer its services to nylon net manufacturers throughout the country.

It is reported that these nets are being dyed in the made-up form and will withstand the severest of laundry wash tests.

EXPLORERS IN ACTION ——— Andy, six-months-old kangaroo, seems more at ease than his "captors", Nelson S Knaggs (left) and Ross M Hastie, vice-presidents of the Hilton-Davis Chemical Co, Cincinnati. Occasion was 52nd annual banquet of the Explorers Club, of which Knaggs and Hastie are members.

• 1956 Chemical Progress Week

Howard S Bunn, executive vice president of Union Carbide and Carbon Corporation, has been named New York State Chairman for national Chemical Progress Week, April 23-28. Thirty-eight chemical manufacturers throughout the State will cooperate in the third annual observance.

Mr Bunn has announced that a kick-off luncheon will be held at the Waldorf-Astoria on April 23 at which the chemical companies will be hosts to a number of leading educators from secondary schools and colleges in the metropolitan area.

The Manufacturing Chemists' Association has announced that "A Better America Through Chemical Progress" will be the theme of this year's program. The celebration will feature speeches, plant tours, essay contests and educators' meetings.

• Moretex Purchases Additional Equipment

In line with general expansion of Moretex Chemical Products, Inc, Spartanburg, S C, Ira Hurd, sales manager, has announced the purchase of additional processing equipment to be made to specifications by Greenville Steel and Foundry Co.

• National Aniline to Build Research Addition

Wesley Minnis, director of research & development of National Aniline Division, Allied Chemical & Dye Corporation, has announced plans for erection of an addition to its Research-Engineering Center located at the Buffalo, N Y plant. This new building will provide increased space for application research on diisocyanates which are being produced by National Aniline Division for sale under the tradename of Nacconates.

The Company's new plant for producing the Nacconates is now nearing completion in Moundsville, W Va. This will provide large-scale facilities for production.

The need for increased capacity for application research has come within a year of the dedication of the new large Research-Engineering Center.

The new addition will be a one-story structure providing approximately ten thousand (10,000) square feet of floor space. It is expected to be completed for occupancy by late 1956.

• Hercules Stockholders Approve 3 to 1 Split of Common Stock

Stockholders of Hercules Powder Company, at their annual meeting on March 20th, approved a 3 for 1 split of the company's common stock. Also approved were an employee savings plan, and a stock option plan. 88% of the outstanding voting common shares of the company were represented at the meeting in person or by proxy — the largest representation of stock at any annual meeting in the company's history.

Along with the stock split, the shareholders approved a change from no par value to 2-1/12th dollars par value a share. The New York Trust Company, transfer agent, will mail on April 30, 1956, to each holder of Hercules common stock a certificate or certificates representing two additional shares for each share held at the close of business April 3, 1956.

Nominees for the Hercules Board of Directors re-elected were:

Leon W Babcock
Wyly M Billing
Albert E Forster
John J B Fulenwider
John E Goodman
Elmer F Hinner
John B Johnson
John R L Johnson, Jr
John M Martin
Paul Mayfield
Edward B Morrow
Anson B Nixon
Reginald Rockwell
Philip B Stull
Ernest S Wilson

• Atlas Electric Devices Names New West Coast Reps

Atlas Electric Devices Co, 4114 N Ravenswood Ave, Chicago 13, Ill, has announced the appointment of two new west coast representatives who will handle both sales and service of Atlas Fade-Ometers, Weather-Ometers, Launder-Ometers and related equipment.

John K Bice Co, 440 Seaton St, Los Angeles 13, will represent Atlas in southern California. Mr Bice has supplied basic raw materials and machinery in that area for a number of years.

Bice

In northern California Atlas will be represented by Pacific Coast Chemicals Co, 2060 Third St, Berkeley 10, a partnership of Harold M Brez and Arthur E Wolff.

Brez

Wolff

Most of the raw products and machinery handled by both companies are supplied to organizations producing products that require predetermined reaction to weathering, fading and laundering. Atlas Ometers thus constitute a well integrated addition to the products already handled by them.

• CCNE Annual Banquet

The Chemical Club of New England held its annual banquet on March 22nd at the Somerset Hotel, Boston, with approximately 500 members and guests attending.

The only organization of its type in New England, The Chemical Club represents an important segment of the New England Economy. Numbered among the attending guests, however, were prominent executives from other parts of the country.

Arrangements for the meeting were handled by Fred Baker, Fritzsche Brothers, and Loring Litchfield and George Smith, E I du Pont de Nemours & Co, Inc, all members of the Program Committee.

DEXTER SALES CONTEST WINNERS———Winners in Dexter Chemical Corp's recent sales contest are shown with Joseph B Evans (second from left), vice president and director of sales. E P Henley, at Mr Evans' left, won the overall sales contest, while William B Griffin (extreme left) and Leonard Schlesinger (extreme right) were tied for first in the product contest.

• Seminar on Synthetic Latex Polymers

A technical seminar on synthetic latex polymers will be conducted for the Southern textile and paper industries on May 4 in Atlanta, Georgia. Sponsored by the Chemical Division of the Goodyear Tire & Rubber Company, the seminar will be held at the Georgia Institute of Technology in the auditorium of the Hightower Textile Building.

Purpose of the Southern seminar is to present to interested members of industry a survey of today's latex polymers. Main topics to be covered include the development, production, evaluation, properties and uses of synthetic latices.

Keynote speaker at the Atlanta meeting will be Herman R Thies, general manager of the Goodyear Chemical Division. In opening the session, he will present a broad review showing the scope of this relatively new industry.

J D D'Ianni, assistant to the vice president in charge of research and development at Goodyear, will speak concerning the "Theoretical Consideration of Polymerization and Latex Characteristics." Later in the program, he will discuss product development.

A E Polson, manager of the Plastics department of the Chemical Division, will describe "Sources of Materials for Latex Manufacture." He also will open the afternoon session with a slide presentation showing production of synthetic latex.

Two papers will be delivered by Willard C Smith, Latex & Adhesives section head for the Chemical Materials Development department. "Properties of Latex Systems and Evaluation Procedures" and "The Influence of Latex Variance on Important Performance Characteristics" are the two topics being reviewed by Smith.

Earl W Scott, sales service representative for the Chemical Division's Coatings department, will present "A Survey of Latex Applications and Potentials" in the various coating fields.

The seminar will be concluded by Thies. His summation will outline the significance of the points presented during the program.

Following the seminar, guests will be invited to inspect an exhibit prepared by the Goodyear Chemical Division. The display will illustrate a variety of applications for latex in the textile, paper, paint and other coatings fields.

A similar seminar was conducted last October to the Northwest paper industry in Camas, Washington. More than one hundred representatives of the paper, lumber, textile and paint industries attended the session.

• Antara Announces Reduced Prices on Acetylene Chemicals

Antara Chemicals, a sales division of General Aniline & Film Corp, has announced new reduced prices on acetylene chemicals being produced at the Company's new commercial plant in Calvert City, Ky.

Publication of the new price list follows closely the announcement that the new installation had gone onstream. The products are being manufactured on a full commercial scale at Calvert City.

General Aniline feels that the new prices will greatly expand the sales of these products which are handled by Antara's new Acetylene Chemicals Department, headed by Daniel B Witwer. Extended applications are also expected to follow, particularly where the price factor may have been an obstacle heretofore.

The new prices for tankcar or carload quantities are:

Propargyl Alcohol	$ .75 lb in carloads
Butynediol, 35% Aqueous Solution	.09 lb. in tank cars
Butyrolactone	.38 lb in tank cars
2, Pyrrolidone	.55 lb in tank cars
Vinylpyrrolidone	.80 lb in tank cars
Polyvinylpyrrolidone	1.25 lb in carloads
Plasdone	3.20 lb in carloads

Technical data and additional information are available from the Acetylene Chemicals Department, Antara Chemicals Division, General Aniline & Film Corporation, 435 Hudson Street, New York, N Y.

• General Aniline to Build Another New Chemical Plant

Construction plans for a new ethylene oxide and ethylene glycol plant were announced on March 19th by General Aniline & Film Corporation as the latest step in its program of chemical expansion and integration. The new facilities, which are expected to cost about $8,000,000, will be located at the existing Dyestuff and Chemical Division plant in Linden, N J.

"The new installation is an important part of our continuing program of expansion in the detergent field," John Hilldring, president, said in making the announcement.

The ethylene oxide from the new plant will be used primarily in the production of the Company's own detergents and surfactants. General Aniline is a leading supplier of bulk detergents and its Igepals, Alipals and Igepons are widely distributed in industrial and household surfactants.

General Aniline's ethylene oxide plant reportedly will have a production capacity of 60 million pounds a year. It will also be equipped to manufacture ethylene glycol of the antifreeze, industrial, and fiber grades, as well as diethylene glycol.

The Scientific Design Company, Inc, New York, N Y, has been selected to design and engineer the new installation and will use their process involving the direct oxidation of ethylene. The ethylene will be purchased from Enjay Company, Inc. It will be brought in by pipeline from the recently announced ethylene facilities of the Esso Standard Oil Company at its nearby Bayway Refinery.

Construction of the General Aniline & Film plant will start in about six months with operations scheduled for 1957.

Other phases of the Company's current expansion program in the surfactant field include a new surfactant plant now being built at Calvert City, Ky, and leasing of large detergent storage tank facilities in Los Angeles and Alameda, Calif.

General Aniline also announced recently that production had started at its new $6,000,000 high pressure acetylene chemicals plant at Calvert City, where products of this field are being manufactured on a full commercial scale for the first time in the United States (see page 240).

• ITS Officers Elected

Charter officers of the newly-formed (Canadian) Institute of Textile Science, elected at a recent meeting, are as follows:

President——L J Sheps, Trilon Chemicals Ltd; *Vice-president*——Colin H Bayley, National Research Council; *Treasurer*——S J Hungerford, Du Pont Company of Canada Ltd; *Secretary*——R V V Nicholls, Department of Chemistry, McGill University. Directors are C E Coke, Courtaulds (Canada) Ltd; Arne Greyborn, Bruck Mills Ltd; Paul Larose, National Research Council; C J Warrington, Canadian Industries Ltd; and W W Metcalfe, Dye and Chemical Co Ltd.

Purpose of the Institute is to undertake and encourage research and development work pertaining to textiles in Canada. Membership requirements are high and it is hoped that fellowships and associateships may be awarded and recognized throughout the world in a few years.

The Institute's charter, which had been previously granted, was unanimously accepted and it was announced that members accepted by June 30th will become charter members of the Institute. Forms are now available and may be obtained from Prof Nicholls.

First technical and general meeting of the Institute will take place in Montreal, April 20th.

Cocker

• Cocker Adds Three Machinery Lines

John Cocker III, president of Cocker Machine & Foundry Company, Gastonia, N C, has announced the addition of three prominent textile machinery lines.

Cocker will manufacture, sell, and service Sucker hot-air dryers in connection with Cocker slasher heads and size boxes. The Company will also sell and service A Monforts line of cloth-finishing equipment on an agency basis, and will manufacture but not sell Thies dyeing equipment. Thies sales will be handled by Texplant Corp, of Stamford, Conn.

Mr Cocker states that this is the initial step in an expansion program made possible by increased production and sales facilities.

• 5th Canadian Textile Seminar

The Fifth Canadian Textile Seminar, slated for June 6-7 at Queen's University, Kingston, Ontario, will again cover a group of subjects of interest to all persons in the industry, ie, fabric manufacturing, fiber development, knitting, mill management, mill engineering, quality control, Canadian research, wet processing, yarn preparation, etc.

The Seminar, organized by The Textile Technical Federation of Canada, 223 Victoria Ave, Westmount, Montreal, PQ, is expected to attract some 400 registrants.

F J Knight, Hubbard Felt Co Ltd, is serving as chairman of this year's Seminar. He is aided by the following Committee members: C E Coke, Courtaulds (Canada) Ltd; H C Mersereau and J W Millichamp, Canadian Industries Ltd; R W Redston, Geigy Dyestuffs; L J Sheps, Trilon Chemicals Ltd; and W W Metcalfe, Dye and Chemical Co of Canada Ltd.

F D Wallace, Domil Ltd, is serving as chairman of the Wet Processing Section, which will feature the following papers: "Developments in the Design of Modern Dyeing Machinery — Factors Influencing Development" — Frank H Marsh, Longclose Engineering Co Ltd; "The High Quality of Automotive Fabrics" — S A Holli, Chrysler Corp of Canada Ltd; "Microscopical Studies with the High-Temperature Microdyeoscope" — Henry E Millson, American Cyanamid Co; "The Acid Felting of Wool" — Malcolm J Reider, industrial consultant; "Dyeing Orlon Acrylic Fiber — Application of Cationic Dyes" — R J Thomas and J P Nearby, E I du Pont de Nemours & Co, Inc; "The Use of Silicones in Wet Processing" — F L Dennett, Dow Corning Corp; "Preparation of Yarns for Weaving and Dyeing," F G LaPiana, Stein, Hall & Co, Inc; "The Dyeing of Acrilan-Worsted" — W H Hindle & T H Guion, The Chemstrand Corp.

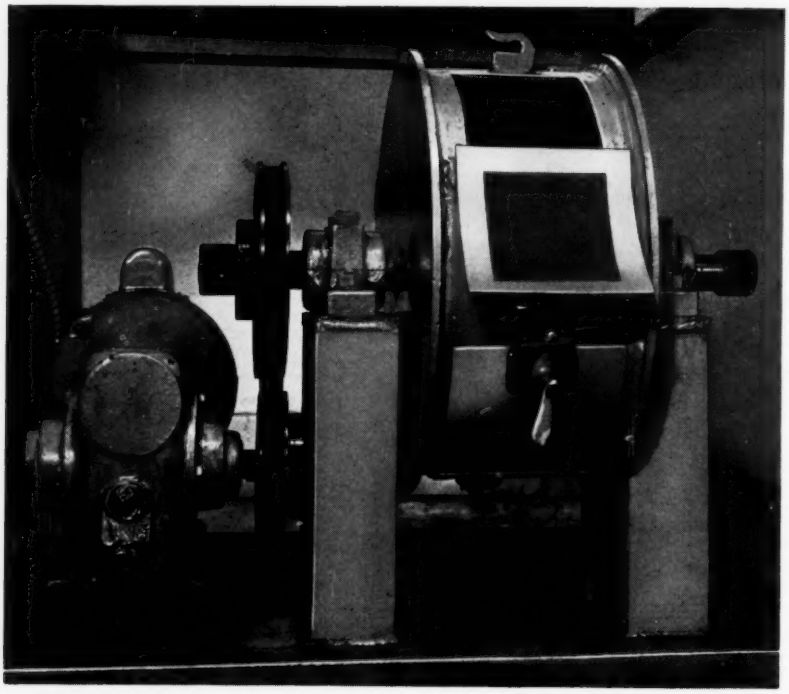
The keynote address at the Seminar will be delivered by Lincoln R Thiesmeyer, president, Pulp & Paper Institute of Canada, on "Group Insurance of Production and Profits."

Complete information and the prospectus may be obtained from the Seminary Secretary, c/o The Textile Technical Federation of Canada.

• Course in the Electron Microscope

The Summer Laboratory Course in Techniques and Applications of the Electron Microscope will be given again this summer from June 11 to June 23, 1956, by the Laboratory of Electron Microscopy in the Department of Engineering Physics, College of Engineering, Cornell University. The course, under the direction of Professor Benjamin M Siegel, will have Professors Cecil E Hall of MIT, Cambridge, Mass and Robley C Williams of the University of California, Berkeley, Calif, as guest lecturers this year.

The course is designed to give members an intensive survey of basic theory and interpretation of results. The registration is limited to a small group so that ample facilities are available for each one to pursue laboratory work in his special field at an introductory or advanced level depending on his previous experience. Further inquiries should be addressed to Professor Benjamin M Siegel, Department of Engineering Physics, Rockefeller Hall, Cornell University, Ithaca, N Y.



Shown above is the Accelerated Soil Tester developed by the Textile Resin Application Laboratory of American Cyanamid Co, Bound Brook, N J. The unit is now being manufactured and distributed by Custom Scientific Instruments, Inc, Kearny, N J. (See page 212 of previous issue).

• ACS Announces New Award in History of Chemistry

Establishment of the first national award for outstanding service in the field of history of chemistry has been announced by the American Chemical Society's Division of History of Chemistry, which will administer the award.

The prize, which initially will comprise $250 and a suitable scroll, will be known as the Dexter Chemical Corp Award in the History of Chemistry. Founded by the Dexter Chemical Corp, New York, to stimulate interest in chemical history, the new award will be presented annually at a meeting of the ACS division.

All persons working in the field of the history of chemistry will be eligible for the award. Selection of the recipient will be made by a three-member committee appointed by the chairman of the division.

The award "shall be made on the basis of services which have advanced the history of chemistry," according to the announcement. Among the types of contribution which will be considered will be: publication of an important book or article on chemical history, furtherance of the teaching of the history of chemistry, and meritorious services in the field over a long period of time.

Eduard Farber, chief chemist of the Timber Engineering Co, Washington, D C, is 1956 chairman of the ACS Division of History of Chemistry.

OBITUARY

ALFRED A HALDEN

ALFRED A HALDEN, executive vice president and director of National Starch Products Inc, died last month at his home in New York following a heart attack ten weeks before. He was 61.

Mr Halden, a chemical engineer, joined the staff of National Starch in 1919 after serving with the Chemical Warfare Service in World War I. A graduate of Columbia College in 1915, he received his chemical engineering degree from the Chemical Engineering School in 1917.

Shortly after joining NSP, he was made manager of their Plainfied, N J plant. In quick succession he took charge of the plant's production, was elected a director in 1932, secretary in 1938, and vice president in charge of manufacturing in 1942.

Mr Halden is survived by his widow, a daughter, a sister, two brothers and a grandson.

• 125 Scholarships Available at LTI

Approximately 125 scholarships valued at $51,000 are available at Lowell Technological Institute for the next academic year starting in September. Specific industries continue to offer grants to students, and departmental, state, city and alumni-sponsored scholarships are numerous.

The scholarships, in general, are awarded on the basis of academic merit, good character, qualities of leadership, and financial need. Application for all scholarships may be made to Dean of Students Richard W Ivers, Lowell Technological Institute, 1 Textile Avenue, Lowell, Mass.

The Celanese Corporation of America offers a fellowship for graduate study at LTI in the fields of textile chemistry and textile engineering. This fellowship pays $1500 per year plus tuition and fees. Application may be made to the Director of the Graduate School at Lowell Technological Institute.

Scholarships available to freshmen and upperclassmen in textile chemistry, textile engineering, or textile manufacturing courses include the Berkshire Fine Spinning Associates, Inc scholarship; the Russell L Brown scholarship donated by the Davis and Furber Machine Company; the Caron Spinning Company scholarship; the Mohawk Carpet Mills textile scholarship; the New England Textile Foundation undergraduate scholarships; the Pacific Mills Worsted Division Overseers Association scholarships; the Sylvan I Stroock scholarship given by S Stroock & Co, Inc; the United Elastic Corporation scholarships; and the Jacob Ziskind memorial scholarship.

Textile scholarships available for upperclassmen only are the Arthur Besse memorial scholarship; the Fiberglas scholarships donated by the Owens-Corning Fiberglas Corporation; the Gehring Foundation memorial scholarship; the Ralph E Hale scholarship established by the Northern New England section of the American Association of Textile Chemists and Colorists; and the Interchemical Corporation scholarships.

• International Textile Dictionary

Herbert R Mauersberger, textile consultant now located at 1525 Levern Street, Clearwater, Fla is forming a group of collaborators to assemble data for an international technical textile dictionary. It will appear in five languages: English, Franch, German, Spanish and Italian. It is estimated that the work will contain ten to twelve thousand terms not found in ordinary dictionaries. Persons who are interested in collaborating on this project should contact Mr Mauersberger.

NAMES IN THE NEWS

Hansen

Bretschger

Elden

HAROLD L HANSEN has been elected vice president of Sterling Drug Inc, in charge of the Hilton-Davis Chemical Co Division. He succeeds the late JAMES F THOMPSON.

Chairman of Sterling's Quality Control Committee since 1947, Dr Hansen has been associated with the company for 14 years.

At a testimonial dinner tenedered to EDWARD R WEIDLEIN March 19th by members of Mellon Institute at the Schenley Park Hotel, Pittsburgh, Pa, announcement was made of his retirement on March 31st.

Dr Weidlein has been prominently and actively identified with the Institute for over forty years, serving as a senior fellow, 1912-1916, and then as an executive staff member from 1916 to 1951, when he was made president of the scientific research organization.

Dr Weidlein is noted internationally as a scientist, research administrator author. He will spend several months in Europe on a Government mission.

ALFRED M BRETSCHGER has been appointed plant manager of the Vancouver plant of the Becco Chemical Division, Food Machinery and Chemical Corporation. He replaces HENRY P VOGT, who will take over the position of plant manager of Becco's main plant in Buffalo, New York. Mr Bretschger has been with the company in Buffalo since 1948, having filled various engineering and production posts there.

Becco also has announced the appointment of RICHARD E ELDEN to the newly created position of production manager at the Vancouver plant. Since 1951 he has been acting in the capacity of chief chemist.

D B MOORE, general secretary of the Textile Institute, Manchester, England and GEOFFREY LOASBY, a fellow of TI and chairman of its Council, visited the Philadelphia Textile Institute during their recent stay in Philadelphia.

The two men are on an extended tour in the United States, visiting various American textile concerns and educational centers.

E D MURPHY has been appointed manager, sales control for Carbide and Carbon Chemicals Co, a Division of Union Carbide and Carbon Corp. Since 1936 he has been district manager for the Boston District.

R L DUNCAN, F J RAUSCHER, and E R YOUNG have been appointed assistant sales managers for the Company. Since 1954 the three men have been serving as division managers, as follows: Mr Duncan, Eastern Division; Mr Rauscher, Southwestern Division; and Mr Young, Central Division.

McCamy

Barnes

Freeman

THOMAS HOWARD McCAMY has been named to the sales organization of Seydel-Woolley & Company, Atlanta, Ga.

Mr McCamy has been associated with Pepperell Manufacturing Company's Lindale (Georgia) plant as overseer of dyeing for the last nine years. He is very active in the affairs of AATCC, having just completed two years as chairman of the Southeastern Section.

Mr McCamy will represent Seydel-Woolley in Tennessee, Alabama, and sections of Georgia.

ROY M BARNES, JR, has been named to the newly created post of sales promotion manager in Du Pont's Dyes and Chemicals Division.

Mr Barnes formerly was in charge of sales promotion in the eastern sales region of Du Pont's Petroleum Chemicals Division. His headquarters will be in Wilmington.

Arnold, Hoffman & Co, Inc, has announced the addition of STANLEY W FREEMAN to its sales force. Previously Mr Freeman has served as a sales representative for General Dyestuff Co and more recently for Pittsburgh Coke and Chemical Co.

Mr Freeman's headquarters will be at the Teterboro, N J office, which is now Arnold, Hoffman's main sales office for its Northern Territory.

Three new managerial appointments have been announced by E F Houghton & Co, Philadelphia.

CHARLES A BILLER has been named manager, Foreign Sales Department. He was formerly assistant manager.

ARMAND J ANDRE, previously a representative in Houghton's Chicago Sales Division, was named to the newly created position of assistant sales manager of the Southern Division, with headquarters in Charlotte, N C.

WILLIAM EISMANN, former supervisor of lubrication and rust preventive research, was appointed acting research manager, following the resignation of K C FRISCH.

WILFRED A SENECHAL, formerly general manager of the screen print division of Goodall Fabrics, Sanford, Me, has been named president of the House of Prints, Inc, 70 East 45th Street, New York, N Y.

Senechal has announced his company's acquisition of the Goodall decorative fabrics screens and prints. It will continue to print these for the decorative trade utilizing the basic Goodall print cloths now being manufactured to original specifications.

In addition, House of Prints will handle a complete line of upholstery, drapery and bedspread fabrics featuring durable type goods especially suitable for heavy duty for hotels, banks, public buildings and institutions.

A further company activity will be as sales agents to the contract field for products of nationally known mills.

McGregor

Sperber

Russell

Loosli

Garnett

Anderson

Metro-Atlantic, Inc, Centredale, R I, has designated ALFRED McGREGOR supervisor in the Dyestuff Application Laboratory. He joins the firm after five years with Arnold, Hoffmann & Co, Inc, where he headed the Providence Technical Service Lab for the past two years. Prior to that time, he had been with John Campbell and Co, Inc, for 22 years, 14 of which he spent as head of that Company's Dye Application Lab.

STUART L SPERBER, formerly with Warwick Chemical Co in the Sales Promotion and Technical Service Dept, has been named director of sales promotion for Metro-Atlantic. In his new capacity, he will be chiefly concerned with Metro-Atlantic's line of durable water repellents. He will make his headquarters in the Company's sales promotion offices at 10 East 39th St, New York.

JACK H FIRPO, formerly sales manager of Woonsocket Color and Chemical Co, Woonsocket, R I, has been appointed official representative for Canada and the United States for Compagnie Francaise Des Matières Colorantes, Paris, France.

In this capacity, he will supervise the activities of the French firm's agent in Canada, Clough Dyestuffs, Ltd, Montreal, Que, and will have as an initial task the setting up of a selling organization in the United States.

GEORGE W RUSSELL has been named general manager, and ALDEN R LOOSLI, assistant general manager of American Cyanamid Company's Industrial Chemicals Division.

Mr Russell was formerly assistant general manager of the Company's Pigment Division, while Mr Loosli held the same post in the Fine Chemicals Division.

R L STOUT, formerly supervisor of office services at the Bound Brook, N J plant, has been promoted to assistant to the director of sales, Organic Chemicals Division.

Product Sales, Inc, Whitman, Mass, has announced the promotion of GEORGE W PARKINSON to sales representative for the state of South Carolina, replacing DUDLEY M DUNLOP, who has resigned because of ill health. Mr Parkinson has been with the firm four years as service representative.

CHARLES E GARNETT has been named service representative covering the states of Georgia, Alabama, Tennessee, Mississippi, and Texas. He was formerly with Tallasee Mills of Mt Vernon Woodbury Mills, Tallasee, Ala.

FRANK ANDERSON has been appointed technical representative for Moretex Chemical Products Inc in the North Carolina-Virginia area. Mr Anderson, formerly with Warwick Chemical Co, will make his headquarters in Greensboro, N C.

At the recent annual meeting of stockholders and directors the McKiernan-Terry Corp, CARL W SHATTUCK was elected first vice president and ROBERT M FORTUNE, a vice president of the company.

Mr Shattuck joined McKiernan-Terry in 1926 as an engineer. In 1943 he was made manager of the Dover plant and in 1946 was elected a vice president. He was originally responsible for and is currently in charge of the Textile Machinery Division of the company.

Mr Fortune joined the company in 1940. He is now in charge of the Roll Division, serving the textile and paper industries.

Other newly elected officers of McKiernan-Terry include GEORGE W BARTLETT and G ROBERT COMPTON as vice presidents and members of the board of directors, HERBERT G DILLON as vice president, and A F WILSON, as member of the board and works manager of the Harrison, N J, plant. In addition, FRANK W HAMILTON was made works manager of the Dover, N J, plant.

Специализация

—RUSSIAN FOR

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